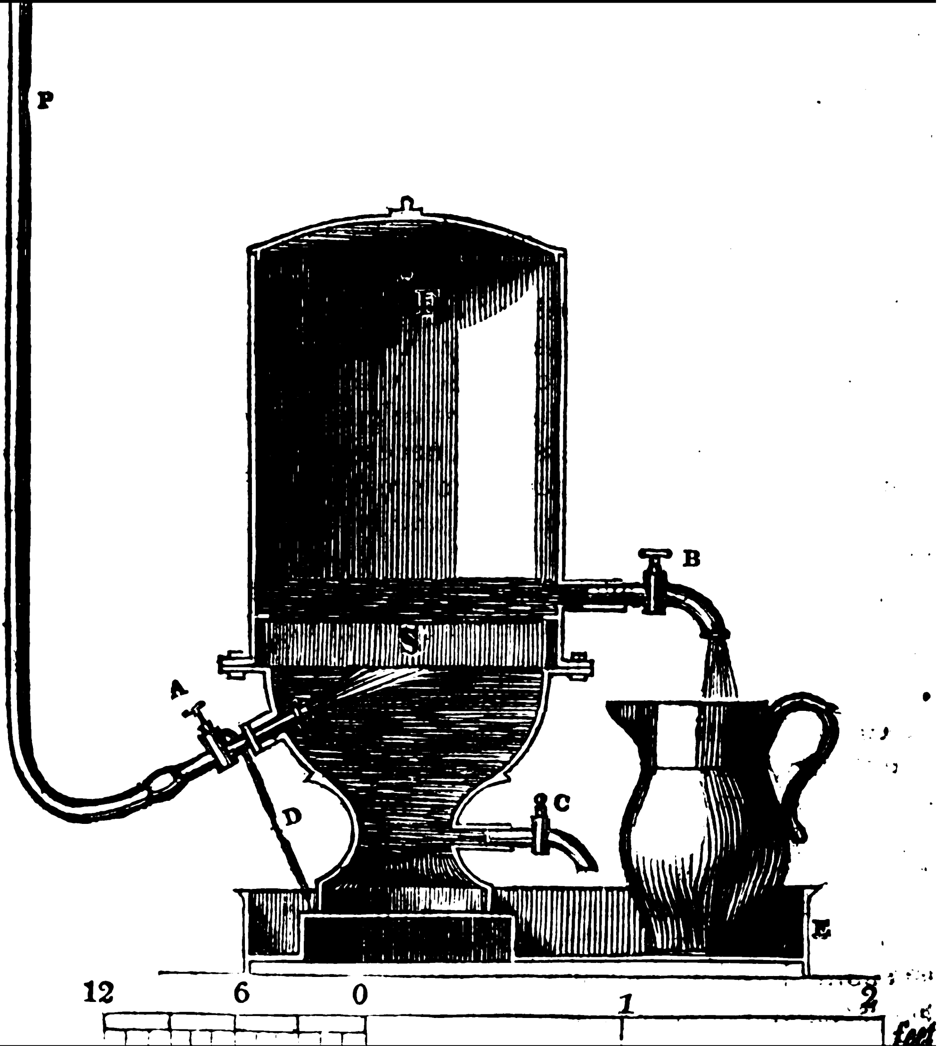

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OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania: —

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED
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JULY, 1829.

On the Mordants used in Dying, Calico Printing, &c.

[Translated from the *Dictionnaire Technologique*, for the Technological Repository.]

[CONTINUED FROM PAGE 379 OF THE LAST VOLUME.]

We see, after what has been above stated, that it is indispensably necessary to employ mordants at different degrees of concentration; and it is easy to obtain this result by varying the proportion of the vehicle. Thus, to procure the acetate of alumine more or less concentrated, it is sufficient to add more or less water to the required quantities of acetate of lead and alum. If we would directly prepare the acetate of alumine, by saturating the acetic acid with this base, the degree of density of the solution indicates its degree of concentration, and the areometer will serve as our guide in this respect; but as this mordant is more frequently formed by the reciprocal decomposition of acetate of lead and alum; and as this last salt contains, besides the alumine, potash, so there is also formed an acetate of potash, which remains in the liquid and increases its density.

In the manufactories of the pyroligneous acid, where the acetate of lime is prepared in the large way for procuring the acetate of soda, and eventually the acetic acid, they have endeavoured to directly apply the acetate of lime, which is but little expensive, to the preparation of the acetate of alumine; and always by the double decomposition of the alum. Nothing is more easy, in fact, as the sulphate of lime thence resulting, possesses so great a degree of

insolubility as to permit this double decomposition; but as, nevertheless, there remains another portion in solution, and as we are obliged to employ an excess of alum, so there always remains in the liquid a large quantity of lime, which produces an ill effect on the tints, which the acetate of alumine is intended to produce; and for this reason it is rejected by the manufacturers of printed calicoes.

From the time when it was known that the acetate of alumine was preferable, as a mordant, to alum, it was admitted, as a necessary consequence of this discovery, that the best proportions for obtaining the acetate, were precisely those in which the two salts were most completely decomposed. And chemical analysis has shown that 100 parts of alum contain 10.5, or nearly, of alumine; but 10.5 of alumine require for their saturation 31.5 of acid: and it will take no less than 116 parts of acetate of lead to furnish this quantity of acetic acid.

We know that the common alum is composed of sulphuric acid, alumine, potash, and water; and we may also consider it as being composed of sulphate of alumine, sulphate of potash, and water. We also know from experiment, that if a certain portion of the acetate of lead be first added, it will become united by preference with the sulphate of alumine; and the only aim of this process being to obtain the acetate of alumine, it results that it is useless to employ more of the acetate of lead than is sufficient to decompose the sulphate of alumine; as all which we add above that proportion is entirely lost.

Agreeably to the data we have given, we admit that the most convenient proportions to obtain a completely reciprocal decomposition, are, 100 parts of alum to 116 of the acetate of lead; supposing that these two salts are in a state of purity, and do not contain more than their proper proportion of water.

As to the mode of preparing this mordant, that possesses no difficulty, only, that as the alum is but little soluble in cold water, so it is convenient to make the solution by heat, and in four parts or more of water. After the solution is effected, we add a little subcarbonate of soda to saturate the excess of acid before we add the acetate of lead; this may be about a tenth part of the weight of the alum: and we then add the proportion of acetate of lead, well powdered and sifted; we then briskly stir the mixture, and renew the stirring from time to time, until it is become quite cold. We then allow it to remain at rest to deposit, and draw it off by the help of a syphon; lastly, we throw the sediment upon a filtering cloth, and strain it hard, in order to obtain the last portions of the liquid.

The mordant thus composed, is one of the strongest which can be employed, and it is seldom necessary to concentrate it, but rather to employ water to dilute it to the requisite degree; and we also know that when thus diluted, it keeps the better.

Most manufacturers, instead of pursuing the course we have indicated, prefer to employ less acetate of lead in procuring the weaker mordants, and think that they find an economy in doing so. Now we think that there is a loss in this respect; for, although we well

know that alum is a good mordant, yet, when we also know that the acetate of alumine is preferable to it, so we find it an advantage to obtain it as pure as possible; and the good quality of the mordant is always proportionable to its richness in the acetate of alumine.

After having thus established, in a general way, the necessary principles for obtaining a good mordant of the acetate of alumine, and which is that which is most frequently employed, we shall next proceed to describe some theoretic rules, which must be followed in order to effect its combination with the organic fibres of the cloth which is to be dyed. Premising that the first condition to be observed is precisely that which takes place in any other combination, that is to say, that the bodies which are to be united be freed as much as possible from all foreign substances, whose presence would necessarily hinder that immediate contact, without which, their union could never be effected; and it is this motive which obliges us to wash and scour the stuffs previous to mordanting them, as we are obliged to clean the surfaces of metals before we wish to combine them, by applying them to each other. This being premised, we must remark, that it is not necessary to uniformly mordant the two surfaces of the cloth, nor is it indeed easy to do it, as it would require them to be completely immersed in the mordant; but it is but rarely this is required: generally, on the contrary, if we would mordant designs which are more or less delicate, and whose outlines are neatly drawn, it would be impossible to obtain this result with the mordant which we have described, or to use it for plate or cylinder printing; or, indeed, in any other mechanical mode. The too great fluidity of the liquid would not permit it to enter the lines of the engraving in sufficient quantity to deposit an adequate portion upon the cloth; but this fluidity would also cause it to spread too much, and thus all the lines of the design would become coarse. In order to obviate this double inconvenience, they have hit upon the following contrivance: in order to give a convenient consistence to the mordant, they add to it a certain proportion of a viscid body, which is not likely to change the tint of the colouring materials, or to exert an improper re-action upon the mordant. The gums, the feculas, either pure or roasted, and also tobacco-pipe clay, are employed with success for this purpose, but not indifferently; and practice has suggested the proper choice to be made of them. We see, for instance, that acids act very powerfully upon the feculas; and we must, therefore, if possible, avoid bringing them into contact with each other. And thus, when the mordant contains a notable excess of acid, it is best to thicken it with a gum. There is also another motive which determines them to give a preference to a gum, and that is, the difficulty they experience, after the action of the mordant has taken place, to free the cloth entirely of the fecula; any small remaining portions of which would injure the brightness and transparency of the colours.

But the advantage which a viscid body procures, that of affording an impression more precise and neat, is subject to the inconvenience of impeding the immediate contact of the two bodies which we wish

to combine. And, therefore, in order to lessen this defect as much as possible, we must only employ that quantity of it which is absolutely necessary; and it is this motive, which merits great consideration, that determines us to give the preference to a body, which, in an equal weight, affords the greatest consistence. This is the reason that they have recourse, in some cases, to pure fecula, to gum tragacanth, and to salep.

These auxiliary substances, however, produce another inconvenience, against which it is necessary to guard; this is, that they experience, under certain circumstances, a too quick desiccation; and lock up, in a manner, the mordant, before it has experienced the modification to which it should be subjected, and which principally consists in the evaporation of its acid, when exposed to a free air.

It is not sufficient therefore, that the mordant should be conveniently applicable, but, also, that it should be placed in the most favourable circumstances for its decomposition, and the combination of its base with the cloth to be mordanted; and this can only be effected in a truly efficacious manner, by keeping the mordanted cloth, for a certain time, in a place where the temperature is moderately elevated, and the air has free access. It is also necessary that the cloth be regularly extended, and that the air which circulates over its surface, be neither too dry nor too moist. It is only by taking these precautions that we can obtain that uniform, but progressive setting free of the acid in the mordant, from which arises the intimate combination of the alumine with the cloth. It is, therefore, necessary for the person who directs the establishment, to be able to appreciate all the influencing circumstances, in order that he may be able to govern them, and to supply what is defective. Thus, in a cold and wet season, he should elevate the temperature of the drying loft, in order to obtain an evaporation more decided; on the contrary, when the atmosphere is too hot and dry, he should either introduce humidity, or add to the mordant a deliquescent material, in order to prevent those signal inconveniences which are caused by a too quick desiccation.

Now even supposing that the application of the mordant, and its combination with the cloth, has been well directed, it does not, therefore, follow, that much of the process has been entirely finished; but we may say with truth, that there yet remains to be performed the most important and the most difficult part of it. In fact, we again repeat, that the mordant is not solely destined to combine with the organic fibres of the cloth, but that it must also combine with the colouring substances; and that, consequently, it must be entirely exposed, and completely freed, from all foreign matters, which might clog and hinder its contact with the colouring matter. This is the principle and the aim of the two succeeding operations, to which they have given the name of *dunging* and *clearing*.

If the mordant which was applied upon the surface of the cloth, had been entirely decomposed, and the whole of its base intimately combined with it, it is certain that a simple washing in water would have been sufficient to raise the viscid substances which were added

to it, and to remove them. But it is not so; as, whatever precaution we take, a part of the mordant remains untouched; and, which is more, a part of the base of the decomposed portion has not entered into a combination with the cloth, but remains free, and in surplus. We must, therefore, contrive the means of removing all these bodies, otherwise there will result another mischief. And as it is evident that in this state, if we were to be contented with merely immersing the cloth in water, that portion of the mordant which remains free, would dissolve and combine indiscriminately with those parts of the cloth which were not mordanted, as we wished to defend them from the action of the colouring matters; but if we add to the washing water a body, capable of seizing the mordant when mixed with it, and of forming an insoluble combination with it, it will then remove it in a certain degree, and prevent it from producing any effect upon the cloth. Such, in fact, is the result we obtain by the addition of cow-dung. This excrementary substance contains a large proportion of soluble animal matters, and of colouring particles, which possess a great affinity for the aluminous salts. The heat which is given to the dung-bath, accelerates this combination, and forms an insoluble and perfectly inert coagulum.

Thus the dung-bath produces a perfect solution of these bodies; a most intimate union is formed between the alumine and the cloth, by means of the elevation of the temperature, which necessarily favours this combination; and an effectual removal of the undecomposed part of the mordant, and, also, in a degree, a mechanical separation of the particles of alumine which were not entangled in the fibres of the cloth, takes place; the entire separation being only completed in the operation of *clearing*, which is done in a large quantity of water, by the aid of the dash-wheel, which produces a movement that greatly facilitates the expulsion of the foreign particles.

We have confined ourselves to giving the theoretic considerations only, which should guide us in the important operation we have been describing; but it may easily be conceived, that many practical observations remain also to be made, which, however, cannot find a place in this article; and, indeed, are only to be learned in the workshops, and not in books.

Before terminating this article, we shall say a few words respecting astringents, and particularly upon gall-nuts, which are arranged amongst the mordants. But it is very difficult to render a good account of the real office they perform. We intend to speak more particularly of them, when we describe the processes for dying black, because in this case they also act as dying materials, and not merely as mordants, as the black results from their combination with the oxide of iron. But we here speak of those circumstances in which we employ astringents as mordants simply, as in the process for dying the Indian red. All that is known in this respect, is, that the astringent matter, or *tannin*, of which the nature is unknown, combines as a mordant, both with the cloth, and the colouring substances, and thus fixes them; but as the colour of the tannin is a

brown, more or less deep, so it follows, that it cannot be employed for light colours. R.

On the Preparation of Gold Sizes and Varnishes.

[From the same.]

Paper, vellum, silk, &c., are readily gilt by various sizes, for which there are many recipes; as the following for instance:—

1. Ale, in which honey has been boiled, mixed with a little gum-arabic.

2. Gum-arabic mixed with sugar.

3. The juice of garlic, or that of an onion, or of hyacinth root, to which a little gum-arabic has been added; these retain the leaves of gold or silver firmly, but we must not use too much gum, lest the gold or silver should crack or scale off.

As these liquids are as colourless as pure water, it is well to mix a slight tint of carmine with them in use, in order to know the places on which the size has been laid. When we apply upon these parts the gold and silver leaves, which we intend to use, we must take up rather larger pieces than the boundaries of the design, and fix them, by applying upon them a tuft of cotton, or lint; and when we think that the size is become dry, rub them over with the cotton, in order to remove those parts of the leaves which are not fixed by the size, and thus render the outlines of the design more exact.

There are certain works which we desire to gild in varnish, but we must know the precise moment when the size becomes of a proper degree of dryness, or otherwise we shall be embarrassed in seizing the favourable moment; for if it be too dry, the gold will not adhere to it; and if it be not dry enough, the leaves of metal will become dull, and scarcely visible. The varnish which the Dutch used to supply us with, has not these inconveniences. A quarter of an hour was sufficient to dry it to a proper degree. The process for preparing it is no longer a secret—it is as follows:—

Into a glazed earthen pot, put a pound of linseed-oil, and six ounces of litharge; also Venice turpentine, black resin, and powdered umber, an ounce of each; likewise an onion and a crust of bread; and then boil the whole for three or four hours. The composition is sufficiently boiled, when, on taking up a little in a ladle, and letting it cool, it draws out into threads. We then remove the pot from the fire, and when the composition is nearly cold, take out the onion and the crust of bread, and add to it four ounces of the essential oil of turpentine; then strain it through a cloth, and preserve it in bottles close stopped for use.

This varnish, or size, although very good, is, nevertheless, not the best. We substitute in place of it another; the process for making which we have procured from England, where it is employed

for gilding in dead gold, as also in bronzing. The following is the recipe:—

Melt one pound of asphaltum, and pour into it a pound of hot linseed-oil, rendered drying by litharge; and also add to it half a pound of red lead, or vermilion. When the varnish by cooling becomes thick or pasty, thin it by adding a pound, or a pound and a half, of spirit of turpentine, as more is required in winter than in summer.

We employ as a gold size, the deposit which forms in the bottoms of vessels, in which the pencils, or brushes, employed in laying on colours ground and mixed with oil, are washed with spirit of turpentine. This matter is exceedingly thick and viscid; it is again ground, and when strained through a cloth, serves as the basis of the size; and the older it is, the more unctuous it becomes.

During these thirty years, the most skilful workmen have, however, discontinued the use of this latter size for gilding in oil, and employ in its stead, a composition to which they have given the name of *mixtion*, to distinguish it from the latter size, of which we have given the recipe. It is a liquid which is found to be the best size for gilding in oil with, as it is thinner, and is not perceived under the gold leaves. The following is the recipe for preparing it:

Melt together one pound of amber, four ounces of gum-mastich, in tears, and one ounce of asphaltum; and add to it one pound of linseed-oil, rendered drying by litharge.

This size must not be used in too liquid a state, nor should it be too long nor too speedy in drying; it should be capable, however, of spreading easily under the pencil.

The manufacturers of paper-hangings use a size of this kind in applying gold or silver leaf upon their works; and also to fix upon the paper the powder of cut woollen cloth, or flock, in order to imitate velvet. The size we have last described the composition of, is highly useful for this purpose.

We can also employ, in gilding or silvering drawings upon vellum, or paper, *gold or silver inks*, of which we shall take the present opportunity to describe the preparation.

Gold Ink.—Take leaves of gold, and add to them a sufficient quantity of white honey, to form a paste with them upon a painter's grinding stone. Then grind this paste with a mullar, in the manner of grinding colours, until the gold is reduced to the greatest state of division possible. Remove this ground paste with a palette-knife, put it into a large glass vessel, and mix it with water. The gold, by its weight, falls to the bottom of the vessel, and the honey dissolves in the water; then decant it, and wash it with more water, until the honey is entirely removed. Dry the gold powder which remains at the bottom, and is exceedingly brilliant. When we would use it for writing or painting with, we grind it up with a weak solution of gum-arabic, and the ink is made. When dry, we may polish it with a dog's tooth.

Silver Ink.—This is made in the same manner as the gold ink, and used like it.

On Metallic Watering, or Moiré Métallique.

[From the same.]

We give this name to a varied crystallization, which exhibits itself upon the surfaces of tinned iron plates, when they are exposed to the action of acids. This crystallization pre-exists in the tin, and is only rendered manifest by dissolving the slight coat of tin which covers it; it is easy to be convinced of this, by an attentive examination of a sheet of tinned iron, when placed in a bright light, and inclined in various directions; we shall then perceive in the coat of tin, certain parts which reflect the light diversely; and it requires but little after this inspection, to know how to produce a species of *moiré*. It is, therefore, surprising, that it should have been so long before any one thought of availing himself of a fact which had been known for so great a number of years. Indeed, the discovery of the *moiré métallique*, was only made in the year 1817, and was then said to have happened by chance. It is, however, certain, that this discovery, like many others, was signally distinguished by the contests, which its author, M. Allard, maintained, in bringing actions against a great number of tin-plate workers, who combined together to support each other, and which ended in exposing the mystery of this new and beautiful art, which had excited the attention of all the curious. We shall now make known the manner of producing the *moiré*, and indicate the principal precautions which must be taken in order to succeed therein.

We have already said, that the *moiré* is constantly formed in the tinned iron plates, and only requires to be brought out; but it requires still to be known, whether it results from a combination of the tin with the iron, or from a crystallization of the tin only. Many persons adopt the former opinion, and they form it, in part, on the fact, that the *moiré* is not perceptible upon the surface of the tinned iron, and does not exist but at a certain depth; that is to say, at the point of contact of the two metals; and that there is really a combination formed between them; and they proceed to prove this kind of reciprocal penetration, first, by the numerous inequalities which are perceived upon the surface of the sheet-iron when the tin is removed by the action of a weak acid upon it; and, secondly, from the white colour of the section of the tinned iron, when cut by the shears. But it is to be remarked, that there is, no doubt, an illusion in these two circumstances, and especially in the last, as it is evident, that by the mechanical action exercised by the shears, the tin is torn off from the surfaces, and carried along by the cut in such a manner as to make it appear that the tin had penetrated to the centre of the iron; but if, instead of cutting the tinned iron, we break it across by bending it a number of times in opposite directions, we shall clearly see the colour of the iron and that of the tin. With respect to the inequalities upon the surfaces of the iron, which are rendered sensible by the action of an acid, we think that they

are caused by the surfaces of the iron not being equally defended from the action of the acid, by the same thickness of tin throughout; and that whilst the acid is attacking the last remaining coats of tin in those parts which were most thickly covered by it, it is also attacking the iron in the others, and thus producing the cavities which are remarked therein after the operation. It is necessary, therefore, in order to attain a perfect certainty in this respect, to employ a solvent which is not capable of acting upon the iron; thus, we may employ with advantage a bath of mercury, in which we may immerse the tinned iron, in order to remove the tin only. However, whether this supposed penetration takes place or not, or the combination be limited to the two surfaces in contact, without penetration, it is by no means the less true, that the crystallization of the *moiré* is always due to the tin, and this is proved by the pure tin-foil affording these crystallizations. We do not, nevertheless, mean to assert, that more beautiful *moirés* may not be obtained by tinning the sheet-iron plates with alloys of tin, containing a little bismuth, or antimony. It is, nevertheless, certain, that the English tinned iron plates, which are marked with the letter F, are best for the purpose; and it is said that their tinning is the most pure. These things being considered, we shall now proceed to describe the process which must be followed in order to produce the *moiré.*

We have above said, that this process consists in corroding the surface of the tin by means of an acid liquor; but before communicating a considerable number of recipes, most of which may be used with equal success, we shall point out the necessary precautions to be observed. We must not lose sight of the fact, that the action of the acid must be exceedingly limited, and that it must not be carried beyond the removal of the thin pellicle which has been planished, either by means of the laminating rollers, or by hammering the sheets after they have been tinned. When the acid penetrates deeper, it will be liable to uncover the sheet-iron, whence there will result dark reflections, or blacknesses, in place of the silvery lustre and the pearly appearance of the tin. Thus the operator must direct his principal attention to the arresting the action of the acid, when it has been exercised the proper time; and we shall commence by giving instructions for its use.

We must prepare, on the one hand, a weak aqua regia, composed, for instance, of four parts of nitric acid, one of either of the muriates of soda, or ammonia, and two of distilled water; and, on the other, we must have an earthen pan filled with water; then, by means of a small sponge, slightly moistened with the acid liquor, we wipe over the whole surface of the tinned iron plate equally, and which had previously been a little heated; when we see the reflections of the *moiré* manifested in a distinct manner, we instantly plunge the sheet into the water, and wash it either with the feather of a quill, or a little cotton, but always in such a manner as to avoid using a degree of friction that might be capable of raising the small portions of tin which constitute the *moiré.*

We may readily conceive that the action will be more quick and

lively in proportion as the acid employed shall be more concentrated, and the temperature elevated. We cannot define the time necessary to be employed at each operation, as it will vary according to the influencing circumstances; thus the action may be terminated in less than a minute, or it may require more than ten minutes.

It is highly necessary to wipe the acid liquor quickly over the surface of the sheet of tinned iron, and not to pour it directly upon it, as the beauty of the *moiré* depends, in a great measure, upon an equal action being exercised over its whole surface; as, otherwise, it would be more brilliant in certain points than in others, and the iron might be exposed, and form black spots.

When the *moiré* has been properly developed, and the sheet has been well washed, so as to leave no remains of the acid employed, lest it should oxide and tarnish soon, we must dry it with care, to avoid employing too great a heat, as in that case it would lose its lustre; and, in order entirely to prevent the ultimate effect of the air upon it, it may either be varnished immediately, which effectually secures it; or, in the mean time, be covered merely with a solution of gum, and which may afterwards be removed by means of water.

The different colours given to the *moirés*, are owing to the coloured and transparent varnishes with which they are covered; and great care must be taken in using the pumice-stone, in order to render the coat of varnish thinner, that it may be equally applied, so that the different reflections of the crystals be the better seen.

The too great malleability of thin leaves of tin after undergoing this species of crystallization, will not permit them to resist the heavy hammering to which we are compelled to have recourse, in fashioning hollow bodies. And, therefore, we are obliged to employ them for plane surfaces, or, at most, for those which are but slightly curved, and which must be done with wooden mallets.

Each combination of these crystallizations, in general, are susceptible of being modified by the influence of certain agents, and especially by that of heat. It is then not absolutely the same thing in producing the crystallization of the *moiré*, and in modifying its grain, whether we destroy it in the whole, or in part, according to the effect we would produce, and leave it to be reproduced by the influence of a cooling more or less prompt. When we expose, for example, a sheet of tinned iron plate to a temperature sufficiently high to melt the tin; if we suffer it to cool slowly, the crystallization will nearly resemble that it possessed before heating it; but if the sheet, whilst hot, be suddenly plunged into cold water, the crystallizations will be all confused, and appear like a kind of sand. But if, instead of effecting the cooling of the whole surface, we only partially effect it, by sprinkling cold water upon it, we can vary the crystallizations. We can also obtain similar results by blowing cold air upon the surface of the tin whilst it is in fusion, and at the moment when it begins to fix. Lastly, we can trace different outlines, characters, &c. by presenting to the surface of the tinned iron plate, the point of a flame, directed by means of a blow-pipe. As the tin liquifies all along the course of the flame, and as in cooling it crystallizes in a

different manner from that it originally possessed, so it results that the different designs may be varied in an infinity of forms. There are also other modes of varying the crystallization of the *moiré*, but we think we have said enough to guide any one; and we therefore leave to every one the satisfaction of creating novel modes of doing it.

We shall now terminate this article by indicating the different mixtures which we can recommend as being capable of affording a fine *moiré;* and we shall thus enable our readers to choose those which they can prepare with most convenience.

1. Two parts of nitric acid, one of muriatic acid, and two of distilled water.
2. Two parts of nitric acid, two of muriatic acid, and four of distilled water.
3. One part of nitric acid, two of muriatic acid, and three of distilled water.
4. Two parts of nitric acid, two of muriatic acid, two of distilled water, and two of sulphuric acid.
5. Four ounces of muriate of soda, eight ounces of distilled water, and two ounces of nitric acid.
6. Eight ounces of distilled water, two ounces of muriatic acid, and one ounce of sulphuric acid. R.

On Guyot's Preservative Liquid for Animal and Vegetable Preparations.

Towards the end of the last century, the French government printed and published a considerable number of instructions on "*The Art of Registering and Preserving the Objects Serving for the Elucidation of the Arts, Sciences, and Education,*" which, however, are now but little known or attended to; and, in consequence, many fine preparations having fallen into the hands of persons but little acquainted with the simple and facile methods of preserving them there described, are rapidly hastening to decay. In consequence, the society of learned men who edit the *Dictionnaire Technologique,* have thought it desirable to re-publish, in that respectable work, some of the chief instructions relating to this interesting object; and from which we extract the composition of this preservative liquid, and the manner of using it as follows:—

The preservative liquid invented by Guyot, which may be used with great success in the preservation of vegetable and animal preparations, deserves the highest consideration. We think that we shall benefit the public by giving the process for preparing it, which is by no means sufficiently known.

Take twenty litres* of the best brandy, and draw off from it, by distillation, five litres of alcohol; then add to the remainder an equal

* The *litre* is equal to 61.02443 English cubic inches.

quantity of spring water, and a pound of the flowers or leaves of lavender, and distil it anew to dryness. This done, take nine parts of the alcohol drawn off in the first distillation, and mix it with sixty-nine parts of spring water, and then add to the latter mixture an equal quantity of the liquid obtained in the second distillation. Thus is formed Guyot's preservative liquid, which possesses great clearness, has a taste of almonds, and a slight aromatic smell; and as it only contains about a thirteenth part of alcohol, so it is by no means expensive.

In using this liquid, the bottles containing the preparations may be tightly closed with corks, which have been steeped for some time in a composition of three parts of wax and one of suet, melted at a temperature not liable to burst or swell the corks: the mouths of the bottles are thus closed with flexible stoppers, the pores of which are rendered impenetrable, and thus prevent all evaporation of the fluid contained in the bottles. The mouth of each bottle may also be closed with a flat plate of glass, fitted to it accurately; the mouth itself having also been previously ground truly flat, by rubbing it upon a flat plate with emery and water; and around the joining may be placed a band of paper soaked in drying oil; or this oiled paper may be covered with laminated lead, over which may be tied, with a thin pack-thread, a piece of parchment, coated with drying oil mixed with lamp-black; the twine being drawn as tight as possible. By taking these precautions, we may hinder all evaporation.

Remarks by the Editor.—We think the method of closing the mouths of bottles containing anatomical preparations preserved in alcohol mixed with water, as practised by the late Mr. Taunton, an eminent surgeon of this metropolis, and a lecturer on anatomy, preferable to either of the above; it was as follows:—

He fitted to the mouth of the jar, or bottle, a thin circular plate of laminated lead, by laying it upon the mouth, and pressing it with his hand all round, in order to receive the impression of the exact form of the mouth upon the lead, and which he then cut to the shape with scissors, leaving it, however, rather larger than the mouth. He then applied a little lard around the mouth of the jar, and fitted the lead over it, burnishing its edges close down all around it. He then covered the lead with a piece of bladder which had been macerated in water until it had became gelatinous in consequence of incipient putrefaction, and tied the bladder closely all over and around the neck and mouth of the jar, or bottle, with twine. He then let it remain to dry, when he removed the twine, the bladder having cemented itself fast upon the bottle by its own gelatine. Lastly, he completed the security of the closure by painting the bladder all over with a black oil-colour, having previously trimmed away with his scissors the excess of the bladder below the tied part. In this way, he found that the liquid contained in the jars, or bottles, was effectually secured from escaping. [*Tech. Rep.*

On Working Cast-Steel, so as to preserve and even improve its good Quality. *By* Thomas Gill, Esq.

The Editor lately conversed with Mr. Scipio Clint, a medal die engraver of considerable talent; he stated, that a circumstance had occurred to him, which he was totally unable to account for; he had a graver, of a very superior quality, indeed the best he ever used; but, suddenly, he found it become quite soft, and entirely useless to him. The Editor explained the circumstance to him, by stating, that the tool had been only hardened for a part of its length, and that the excellent quality of it arose from his using that portion of it which immediately adjoined to the soft part, and where, consequently, it had only received the proper degree of heat, to preserve the steel in its best state. That the soft part immediately adjoining the hard part, was, in fact, as soft as the steel was capable of being rendered; so that, on grinding or whetting his tool, to renew its edge, he had at length got through the hardened part, and had suddenly entered into the soft part of it.

This circumstance deserves to be more attended to than is generally supposed, and we can always command that part of the steel, which is of the best quality, by carefully heating the point of the tool, and quenching it in water; we then with a file, try which part of it is hard, and which soft, and choose that portion of it which most nearly adjoins to the soft part, to form our cutting point or edge.

If, besides, we previously heat the steel to a degree just short of the hardening point, and quench it in water, we shall find that it is quite soft, and is capable of spreading or yielding under the hammer, and we can then close its pores, and condense it in the most effectual manner. We must then, as above-mentioned, again carefully heat, and quench it in water, and form it into our tool; and, provided the steel be of good quality, we shall thus have availed ourselves of every circumstance necessary to ensure its perfection. It is surely well worth while for workmen wishing to possess excellent tools, to avail themselves of these instructions, and which a very little practice will enable them to do.

If steel be overheated, as is most generally the case in the ordinary methods of working it, it is quite impossible to obtain a good result; and, therefore, in proving every fresh bar of cast-steel, we should always ascertain the proper, or least, heat at which it will harden, and endeavour, as much as possible, in forging it, not to exceed that degree of heat; and we shall then preserve the good qualities of the steel in the highest degree. And although it will certainly require more labour to work it, at a heat lower than usual, yet, when we wish to procure excellent tools, it is worth while to bestow that extra labour upon it.

The following is a case which lately occurred to the Editor, and will serve to elucidate the above remarks. He found a young man labouring to drill holes through thick iron wheel-tire, but he made

such slow progress, that he thought his drill must have been improperly shaped, and accordingly suggested an improvement in its form; still, however, the desired end was not obtained; and, accordingly, he advised him to forge it anew. On proceeding to do this, he heated it, as usual, to a white heat, which the Editor told him must certainly greatly injure its quality; and, indeed, it proved so in the event. On this, he desired him to cut off the burnt part of the drill, and endeavour to find out the lowest degree of heat at which the steel would harden; he did so, and then worked it into form at that heat, and proceeded, under the Editor's instructions, to make a drill, with the proper degree of care. When the drill was finished, he found that he could perforate the iron-tire in a much less time, and more easily, than he ever before could accomplish; and promised, that, in future, he would carefully attend to the lesson he had thus received, on working cast-steel to the best advantage.

In the *Technical Repository*, we have given numerous articles on the proper methods of working cast-steel, to which we must refer those of our readers who feel interested on the subject. What we here state, however, contains the essential particulars necessary to be observed, in order to obtain good tools; and we know of several excellent workmen, who carefully work their steel according to them; and particularly, in making dividing-knives, for cutting the divisions on the limbs of astronomical and other instruments, and which require to have an exceedingly thin and perfect edge, in order to cut the divisions fine and deep.

These tools may possibly require to be tempered after hardening them, as usual; if, however, they will stand without tempering, which will frequently be the case, so much the better. The steel will be found to be much denser, when worked in the manner here recommended, than when it has been overheated, as is too commonly the case in the ordinary methods of working it.

If the tools require to be made of a good quality for a considerable length, then we must endeavour to heat them *uniformly* to the proper degree, before quenching them to harden them. This may be accomplished, if, instead of heating them in the forge fire, we employ an iron tube, closed at one end, such as a piece of a gun-barrel, or of a gas-pipe, and place it in the forge fire; and especially if we also make what is termed "a hollow fire" over it, which will tend to preserve the tube at a more uniform heat. We can thus heat the tool in the tube for a considerable length, to a uniform degree, and procure tools whose good qualities will endure for a considerable period, provided, that we carefully ascertain the proper hardening heat of the cast-steel, and endeavour to keep the tube at that degree. The tube has also the good effect of preserving the steel heated in it from coming in contact with the *pit-coal*, of which the fires of forges are commonly made, and whose quality is very frequently of a most prejudicial nature. It would be much better to make the fires of *charcoal*, as indeed is practised by some excellent workmen.

It is well to observe, that the entire of every bar of cast-steel, will, in general, be found to be of the same quality; and, therefore,

that one trial, to ascertain its proper hardening and working heat, will be sufficient for all the articles to be formed out of that bar; and, indeed, that all the bars drawn out of one ingot of cast-steel would also be of a uniform quality, provided that due care had been taken in the drawing them out not to overheat them. As, however, it must unavoidably happen, that the bars drawn out of various ingots must be mixed together, before they can be brought into a state for sale; so it becomes necessary to try every individual bar, in order to ascertain its true hardening heat.

The quality of various articles made of cast-steel may also be greatly improved, even after being hardened and tempered; such as saws, trowels, scythes, hay-knives, and other thin articles, provided they will admit of being heated to the *spring-temper*, or of being *blazed off*, as it is termed; as at that heat the steel is capable of yielding to the blows of a hammer, and thus becoming very considerably denser, than as left from the hardening. In this way Mr. George Walby improved the quality of his long celebrated bricklayer's and other trowels, by dexterously giving them a rapid succession of blows with a hammer, when laid upon an anvil; and thus, at the same time that he removed the warpings occasioned in them by the hardening process, he greatly increased their density, and consequent durability.

Some cast-steel articles are even susceptible of being condensed, and their quality consequently improved, after being hardened and tempered, without being heated at all. In this way, as we have formerly stated,* Mr. Edmund Turrell, our engraver, has improved the gravers commonly sold at the tool-shops, to that degree, as to render them capable of cutting the steel-plates, now so frequently substituted for copper-plates. This he effects by placing the back of the graver upon an anvil, and, striking upon its edge, with the pane of a watch-maker's hammer, a number of light blows in succession, and which he finds will have the effect of blunting its edge to a certain degree, but that afterwards he can no longer produce any impression upon it; and, indeed, this period is ascertained by the sharp ringing sound produced by the blows, when the steel has received their condensing effect. He then again grinds and renews his edge out of this hard part of the graver, with the good effect above mentioned, of its being rendered as capable of cutting steel as copper.

The teeth of narrow saws, may be also condensed by hammering upon the tops of them, in the manner above described, and which has likewise the good effect of *thickening* or spreading them sideways, and thus enabling the saw to work more freely, after the teeth have been again sharpened, by filing them as usual; but with care, nevertheless, not to remove or file away their condensed points or tops. The saws will thus not only be fresh sharpened, but will also cut much harder metals, than they were capable of doing before being thus treated.

The thin points of small drills, are also susceptible of being con-

* See vol. i. page 51, of the Franklin Journal.

densed by hammering their flat sides, after being hardened and tempered; as was found by Mr. Andrew Pritchard, who, upon our suggestion, adopted it with considerable advantage, as we stated in the Franklin Journal, vol. i. page 83; and the drills were thus rendered fit for perforating metals, which they were quite incapable of acting upon in their merely hardened and tempered state.

Many of our readers must, no doubt, have witnessed the effect of the softening action, occasioned by quenching cast-steel, at a heat just below the hardening heat, by finding the stems of their small drills to become twisted in use, close to their hardened points. And therefore, if, in renewing their points as usual, by heating them in the flame of a candle, they carefully observe to quench their points in water, at a heat just below the proper hardening heat, they will find them to yield or spread under the hammer most readily.

In confirmation of our above recommendation of employing charcoal as fuel, in the forge fires used for heating cast-steel in, we may add, that Mr. Fox, the celebrated engineer and lathe manufacturer, of Derby, has long used it, in a small portable forge; and also, that he coats over his steel articles with a thin layer of loam mixed with water, by dipping them into the mixture, and which he dries upon them previously to putting them into the fire, in order to avoid oxiding or scaling them; and that the loam instantly flies off the articles, on dipping them into water to harden them, so as not to impede that operation in the least degree. That scientific citizen of the United States, Mr. Lukins, whose communications have frequently formed a part of our *Technical Repository*, as well also of the *Technological Repository*, also employs loam for a similar purpose.

[*Ib.*

On Preparing Hydraulic Cements. By M. Pasch.*

M. Pasch has not only made many experiments, during the progress of the canal at Gœtha, in Sweden, on preparing hydraulic cements, but had also done so for several years previously.

In a work prepared by him especially, on the researches in hydraulic cements, he commences from the earliest periods, and also cites the experiments recently made both by the English and the French; finally concluding with the results of his own experience. M. Pasch tried various species of lime found in Sweden; these he successively mixed with aluminous slate, or schistus, burnt clay, manganese, trapp, grunstein, pulverized granite, and ochre, and has given the results of all these experiments. The author gives the preference to the aluminous schistus (*alunskiffer.*) He found it difficult, he says, to mix it with any species of lime, without improving the quality of the lime. In order to do this, he burnt it, and reduced it to powder.

* From *Jern-Kontoret's Annaler*, vol. viii. 1824.; and Ferussac's *Bulletin des Sciences Technologiques*, for Nov. 1828.

And thus he produced cements, possessed of the necessary qualities of quickly drying, and of great tenacity. The author allows, indeed, that on account of carriage, this substance is rather costly; but he nevertheless thinks, that the great advantages which it produces, will well compensate for the expense of it.

M. Pasch made more than a hundred experiments on manganese, which has been so greatly recommended, to be employed in the formation of hydraulic cements; he used it both in its natural and in its calcined state. It has been stated, that we could obtain a good cement from mixing pulverized lime, manganese, clay, and sand together, and well incorporating the mass. He thinks, that in this case, the good quality of the cement is due to the clay, and he could not perceive that any advantage was derived from the manganese, and therefore advises that it be omitted. Neither could he find, that much good was obtained from the use of trap, grunstein, the powder of burnt granite, and ochre; nevertheless, he thinks that the last mentioned substance did a little contribute to the improvement of the cement.

With respect to the various kinds of lime, the author has found that they are all susceptible of being converted into hydraulic cements; but that the limestones of the alluvial formation, (*flodlægrige,*) produced a better lime than those belonging to the older formations. That a considerable portion of argillaceous earth, mixed with the lime, caused the cement to endure longer under water; that the siliceous earth gave the cement a greater degree of hardness, but did not prevent it from experiencing the effect of water upon it. He found that the bituminous calcareous stones were the best, on account of the portion of aluminous schistus, which was contained in all those which the author assayed. The cements made with these kind of limestones, became dry in a few minutes, and acquired the hardness of stone; and he thought they might completely replace the famous Parker's cement.

It was proved, from the following chemical analysis, that the two cement stones contained very near the same substances:—

Calcareous Bituminous Stone, from Matola, in Sweden.	per cent.	*Cement-stone from Harwich.*	per cent.
Carbonate of lime -	66,81	Carbonate of lime -	60,63
Carbonate of iron -	3,49	Mica - - - -	2,33
An indeterminable trace of manganese and mica		Carbonate of manganese	3,49
		Oxide of magnetic iron	8,01
Aluminous schistus -	29,53	Aluminous schistus -	24,30
	99,84		98,76
Loss -	0,16	Loss -	1,24
	100,00		100,00

It is without doubt desirable, adds the author, to determine the

exact proportions in which we should mix the different ingredients, to form a good cement, but much depends upon the quality of the lime employed; and as the composition of the different kinds varies so much, so it is not possible to determine the proportions of the other ingredients. M. Pasch speaks of the lime from Faalhagen, which is procured from the lower strata, upon the border of the ocean, as having proved excellent in the works for the Gœtha canal; this stone is of a reddish tint, and contains fifty per cent. of lime; the remainder being a siliceous earth, mixed with the oxide of iron; and also a little argillaceous earth, and oxide of manganese. After being burnt, the stone gave twenty per cent. of pure lime. This lime afforded an excellent cement, when prepared in the following manner. Pulverized lime, not slacked, one part by measure; and sand, half a measure; or instead thereof, lime pulverized, and not slacked, four measures; sand, two measures; pulverized aluminous schistus, one measure. For the rest, the author is unable to give a general formula for mixing the ingredients of a good cement, but he indicates, at least, the principles according to which the mixture should be made. Thus, when the sand and the aluminous schistus have been mixed in proper proportions, the quantity of lime to be added should be such, as that the hydrate of lime should fill all the interstices of the mixture. Before proceeding, however, to make a good mixture, it is necessary to know many particulars; for instance, the volume of hydrate of lime, which is obtained from a measure of pure lime; the degree of compactness afforded by the sand and the aluminous schistus to the mixture; and lastly, the capacity of the empty spaces which remain between the particles of sand, &c. [*Ib.*

*On the Art of Performing Mosaic Works.**

On the preparation of the enamel.—The enamel, consisting of glass, mixed with metallic colouring matters, is heated for eight days in a glass-house, each colour in a separate pot. The melted enamel is taken out with an iron spoon, and poured upon a polished marble slab, placed horizontally; and another flat marble slab is laid upon the surface of the melted enamel, so that the enamel cools into the form of a round cake, of the thickness of three-tenths of an English inch.

In order to divide the cake into smaller pieces, the cake is placed upon a sharp steel anvil, called *tagliulo*, which has its edge uppermost, and a stroke of an edged hammer is given upon the upper surface of the cake; the cake is thus divided into long parellelopipeds, or prisms, of three-tenths of an inch square; and these parellelopipeds are again divided across their length by the tagliulo and hammer, into pieces of the length of eight-tenths of an inch, to be used in the mosaic pictures. Sometimes the cakes are made thicker, and the pieces smaller.

* From "A Journey in Carniola, Italy, and France." By W. A. Cadell, Esq.

For some pictures, the enamel, whilst fused, is drawn into long parellelopipeds, or quadrangular sticks, and these are divided across by the tagliulo and hammer, or by a file; sometimes, also, these pieces are divided by a saw without teeth, consisting of a copper blade, and emery; and the pieces are sometimes polished on a horizontal wheel of lead, with emery.

Gilded mosaic, is formed by applying the gold upon the hot surface or a br[illegible] enamel, immediately after the enamel is taken from the furnace; the whole is put into the furnace again for a short time, and when it is taken out, the gold is firmly fixed in the surface. In the gilded enamel used in mosaic at Rome, there is a thin coat of transparent glass laid over the gold.

On the ancient enamel.—The ancient Romans, besides the enamel for mosaic, made other works in enamel. Winkelmann mentions ancient tiles, of a kind of glass, or enamel, for paving the floors of rooms; and he describes a small picture, composed of filaments of enamel, of different colours, agglutinated by fusion, and each transverse section of this, gave a picture like that at the extremity.* The antique pastes, or artificial gems, are also the products of an art allied to enamel.

Some of the ancient mosaics are said to be formed of coloured stones, but the greater number are composed of pieces of enamel.

The manufactory of mosaic pictures at Rome, belonging to the Pope, is in a large building to the south of St. Peter's. The building contains a collection of enamels, drawn out into the form of sticks. These are arranged according to their colours, in an extensive suit of rooms. The number of shades of colour is 17,000!

The enamel is very fusible, so that the small sticks can be melted, and drawn out into a finer size, at the flame of a candle, without the assistance of a blow-pipe.

Mosaic pictures of a moderate size, are imbedded in a case of copper, which has projecting crooked pieces of copper soldered to the bottom of it, in order to fasten the paste or mastich in which the pieces of enamel are stuck.

Large pieces are imbedded on a slab of stone, or affixed upon the surface of a wall. Anciently, the paste in which the pieces of mosaic were imbedded, called in Italy stucco, was composed of one measure of quick-lime, quenched in water, and three measures of pounded marble; these were made into a mass, with water and white of egg, and this was called marmoratum; but this paste hardens too rapidly, so that it is hard before the workman has time to insert the pieces; and it is injured by damp, more readily than the cement made with oil.

The paste now used is composed of one measure of quenched quick-lime, and three measures of powdered travertine stone; these are mixed with linseed oil, and are stirred and worked up every day

* Winkelmann. *Hist. de l'Art. Livre* 1, *chapitre iii.* We have seen compound rods of enamel thus formed, and small pictures of various sizes, according to the degree of thinness to which the rods had been drawn out.

with a trowel. The mass is at first level on the surface, but afterwards swells up. Each day some oil is added, to prevent the mass from becoming dry and untractable. The mass is ready in a shorter time in warm weather, than in cold; in summer, the mass is at its perfection in twenty days; this is known from its ceasing to swell, the water that was in the lime having evaporated; the mass is then uniform throughout, like an ointment. In winter, and when the air is moist, it requires a month to bring the paste to perfection.

The wall on which the mosaic is to be applied must have the lime taken off its surface; then furrows, an inch deep, are formed in the wall to fix the cement.

For the same purpose also, large-headed nails are driven into the joints to the wall, and wire is drawn from one nail to another.—After this, the wall thus prepared is painted over with linseed oil. Then the cement is laid on to the extent of as many palms as can be executed, before the cement dries. The plasticity and softness of the cement lasts about twenty days; after that the oil exudes, and the lime and travertine becomes a hard mass. The cement made with linseed oil is yellow, that made with white of egg is white, and the white cement is considered to be a character for distinguishing the old mosaic, from the modern; but some of the modern is also made with white cement.

The pieces of enamel are taken hold of with a forceps, in order to insert them into the cement.

The French government, during their dominion in Milan, employed Giacomo Raffaelli, an artist of the Roman school of mosaic, to make a copy of the picture of the Last Supper, by Leonardo da Vinci, which is in the dining-hall of the suppressed monastery of Santa Maria delle Grazie, and occupies one end of the hall, of the same size as the original; namely, about twenty-four feet by twelve.

This mosaic, one of the largest that has appeared, is imbedded upon twelve slabs of marble, from the lake of Maggiore; these twelve pieces were placed together on tressels in the work-shop, in a horizontal position, so that it was necessary to view the picture from an elevated gallery. It occupied the labour of eight or ten men daily, during eight years, from the commencement to its completion, and cost £7,500 sterling.

After the bits of enamel are fixed into the paste, and the whole is allowed to dry for two months, the surface is brought to a plane, and polished, by means of a flat stone and emery. A lapidary's wheel and emery is also used for polishing the surface of individual bits before their insertion. After the surface of the picture is polished, the interstices between the pieces of enamel are filled up with a paste of the same colour with the adjacent pieces.

Rome is the principal, or rather the only school of mosaic painting at this day in Europe. And besides the great establishment, there are many artists who work in mosaic there; and a variety of small mosaic pictures are made for ornamenting rings, snuff-boxes, and other toys.

Communication on the Structure and Economy of the Greenland Whale, made at the Royal Institution of Great Britain. By J. Harwood, M. D., F. R. S., Professor of Natural History in the Royal Institution.

This discourse was illustrated by means of a very extensive series of specimens, &c.

There is, perhaps, no part of the history of the animal world which is less generally known, to those who have not devoted particular attention to zoology, than that of the cetacea; nor certainly is there any, more justly entitled to our consideration, from the sublime examples which this tribe affords of creative wisdom and power. I have, therefore, chosen the Greenland whale for our consideration this evening, because no individual can be expected to offer for our contemplation, more impressive illustrations of the Creator's attributes, than this stupendous piece of animal mechanism; and, especially, when, not contented with understanding its mere distinctive characters, we regard those conditions in its existence, and those curious modifications in structure, which have adapted its ponderous bulk to a medium, whose specific gravity is so like unto its own, and which afford to its progressive motion the widest geographical range.

Although our yearly intercourse with the cetacea during some centuries, has, in modern times, materially extended our knowledge of this gigantic race of beings, we should greatly err in supposing, that their remarkable submarine habits and economy escaped the attention of the observers of antiquity; and it would be an injustice to the memory of so true a philosopher as Aristotle, were I now to omit to mention, that the interest which was excited in his capacious mind by the wonderful characters of cetaceous animals, conducted him to a knowledge of the nature of these creatures, which is calculated greatly to excite the surprise of those naturalists whose opportunities of investigation have even been the most extended.

I shall, therefore, notice a few of his observations concerning them, which may prove interesting, from their accuracy, from their antiquity, and from the infant state of natural science at the period in which they were written.

"There are," he says, "some animals, which receive and return the water, for the same reason, as others which respire, receive and return the air:"—here he of course alludes to fishes, which, in the act of respiration, receive the water through the mouth by the expansibility of their fauces, and return it through the beautiful laminated surfaces of their breathing organs, or gills:—"but there are others," he adds, "which do so," that is, receive and return the water, "on account of the nourishment contained within it; and, since they receive their food in water, it is necessary that they should have an organ by which the latter (the water) may be returned or ejected; such animals, therefore, which employ the water in a man-

ner analogous to respiration, have gills; but those sanguineous (warm-blooded) animals, which employ the water on account of the food it contains, have spiracles, or blow-holes." This, it will be observed, is a very interesting distinction between the fishes and the creatures on which we are now treating.

Aristotle's observations on the sense of hearing, and on the voice of these animals, are also highly philosophical; after showing the incompatibility of voice with the structure of fishes, allowing, however, that many do produce certain sounds, he adds, in regard to the cetacea, "the dolphin likewise produces a stridulous sound, and murmurs when he comes into the air; yet not like these fishes, for the sound emitted by the dolphin, is voice, since he possesses lungs and an air tube, although he cannot produce articulate voice;" and again, he says, in regard to his respiration, "when caught in nets, he is soon suffocated, in consequence of not respiring, although out of water he lives a long time, murmuring, and making sounds analogous to those of other animals which respire air."

After these and many other equally admirable observations on the part of Aristotle, it appears surprising that the cetaceous animals should ever have been erroneously associated with fishes in the works of more recent naturalists, from their mere possession of a fish-like form, and the consequent absence of hinder limbs; conditions which are rendered necessary by their fish-like progression.

Yet not only Ray and Willoughby, but even Linnæus, in his earlier works, improperly placed them at the head of that class. Linnæus, however, afterwards followed Aristotle, in justly considering them as a tribe of creatures which resembled quadrupeds in disguise; since, unlike fishes, they not only, as we have seen, breathe the air by means of true lungs, but they closely resemble quadrupeds in much of their general construction, in their manners, in their intelligence, and in the energy of their senses. Their hearts, also, which propel warm, red blood, present no material modification in their structure from those of quadrupeds. Their other viscera somewhat resemble those of the ruminantia, and the size of their brain often even exceeds that of the generality of the mammalia.

Being, therefore, mammalia in their economy and their structure, they, in fact, only resemble fishes in inhabiting the same element, and in possessing that external fish-like form, which, being the best adapted for aquatic avocations, necessarily occasions differences in the details of their internal structure. The most obvious and striking peculiarities, which first attract our notice in the skeleton of the cetacea, are, the enormous size of the head, in the whales; the almost entire absence of neck; the length and similarity of the bones of the spine; their ribs being comparatively few in number; the shortness of their arms; and the absence of hinder extremities, an os sacrum, and a true pelvis. Whales have, nevertheless, the rudiments of the latter, although the two bones which represent it, neither unite before, nor are they attached to the vertebræ.

The excessive shortness of their necks, although composed, generally, of only one bone less than the longest neck of a quadruped—

as that of the giraffe, for example, renders any separate motion of their heads almost impossible, since the bones of the neck of the whale kind are excessively thin, and immoveably joined together. This, I am disposed to consider as a condition favourable to rapid progression, as that of birds is assisted by the immoveable state of the spine of the back, by which their centre of gravity is rendered less liable to be varied, and their bodies to be thrown out of equilibrium during their rapid flight; for, did the spine of the back of a bird possess great flexibility, its centre of gravity would be probably changed by every extra effort of either wing; and to counteract the same tendency, therefore, the necks of whales and of fishes, have, probably, been rendered equally immoveable.

The Greenland whale may, I think, be considered as typical of the order cetacea, a tribe of creatures which, unlike fishes, generally possess only two fins, with the exception of the tail; and, although some species possess a third fin, on their backs, this latter possesses no bone in its composition; so beautifully is the analogy preserved between these animals and the rest of the class mammalia to which they belong. When, indeed, we examine the cetacea more critically, we find that these instruments, which present the external appearance of breast fins, by means of which they sustain their equilibrium, and perform gentle motions, owe their present fin-like form simply to the covering with which they are invested; for, instead of being composed of straight spines, like those of fishes, they conceal bones and muscles, formed very like those of the fore legs of land quadrupeds; but their hand alone appears externally, and we see it so enveloped in dense skin, that its fingers have no separate motion. But, as the several bones of the fingers are united together by means of intermediate cartilages instead of capsular ligaments, the fins, or, more strictly, the hands, possess great pliancy and strength, and enable the whale kind to spread them upon their sides, and on the breast; and, as Aristotle observed, in this way, to sustain their young beneath them, closely compressed to their bodies.

The fin or hand of the common whale, is flat, and of much greater proportionate size, than in many other cetaceous animals, which extension of the organs of equilibrium appears to have been required to compensate for the more unwieldy construction of the body of the creature. Yet, from the structure of the true and finely organized hand of the ape tribe, to the rude fin of the whale, we perceive no abrupt progression; since the fore extremities of the amphibious mammalia are precisely intermediate in their formation.

These beautiful gradations in organization, afford some of the most interesting and apparent exhibitions of intention or design, which are presented to our notice in surveying the animal world; we may trace the gradual conversion of the hand or fore foot of the terrestrial quadrupeds into the fin of the whale, most obviously, by commencing with such quadrupeds as only occasionally frequent the water, in which the fin, or web between the toes, is short and imperfect; and thence proceeding in our examination, successively, through the otters, seals, walrus, the manati, dugongs, to lastly the

whales, in which all the external appearance of a true hand is lost, though, internally, its structure yet identifies the fin with this organ,

The tail of a large whale measures about twenty-five feet across. It is composed of several layers of tendinous fibres, strongly matted together within an oily membrane; which structure imparts to it immense mechanical strength: it is also flattened horizontally, for the purpose of frequently and suddenly forcing the creature to the surface of the water to breathe; while the tails of fishes, on the contrary, are formed vertically, because their actions being performed chiefly in the depths, they do not require to rise frequently to the surface. But, in the whale, the tail, which is moved by immense depressor or flexor muscles, which are inserted into it, and form two large ridges beneath the body, becomes, from its enormous size and power, the most destructive instrument of defence with which any animal has been gifted. When whales are feeding near the surface of the water, this instrument acts with comparatively little force; for their hands, or breast-fins, are almost sufficient alone, to modify the movements of their bodies, and thus they swim slowly backwards and forwards, with the mouth generally wide open, and rise at each extremity of their short course to breathe. In playing on the surface, they also move in circles, and, occasionally, with the agility of the salmon, they may be seen to elevate their vast bulk almost out of the water; but, when the violent impulse by the tail, necessary to such an action, is differently directed, they dart like an arrow downwards into unfathomable depths, or they rapidly extend their progress over vast tracts of the earth's surface.

But while we contemplate with surprise the voluntary powers of this creature in its native element, how great is our amazement in regarding the involuntary muscular efforts of its heart and arterial system! Mr. Hunter having first informed us that he found the principal artery of the body to measure not less than three feet in circumference, and that it received from ten to fifteen gallons of blood at every pulsation of the heart. Therefore, as Dr. Kidd has observed, if we consider the heart of the whale not to exceed twenty pulsations per minute, at this rate of fifteen gallons received by the artery at every pulsation, we find that not less a quantity than four hundred and thirty-two thousand gallons, or eight thousand hogsheads of blood, do literally pass through the heart of a whale during every twenty-four hours of the creature's existence.

I may, however, observe, that my friend Dr. James Alderson, who has more recently had an opportunity of examining the heart of the same species of whale as the one to which Mr. Hunter alluded, although he found the aorta to be of equal size, supposes that the capacity of the left ventricle was not equal to the reception of more than eight or ten gallons of blood.

The heart of the whale, although much flattened, presents, otherwise, no important deviation in its structure from that of terrestrial quadrupeds; but, like that of other diving mammalia, and of the seals which I described on a former occasion, it is connected with an enormous development in the arterial and venous systems, in

order to preserve it free from the oppression which would otherwise be occasioned by the returning blood; thereby to extend the intervals between respiration: to this end the vessels, in various parts of the body, as Mr. Hunter observed, form, by their innumerable tortuous subdivisions, vast spongy receptacles; and, in other situations, the trunks themselves seem to be proportionately much enlarged. The proportionate quantity, also, of blood in the whale, as in the seal, appears to be far greater than in land animals, which is, indeed, the case in all the aquatic mammalia.

I recollect having been surprised by an observation of an old Greenland captain, that the blood of all the animals of high northern latitudes was of a much darker colour than in those of more southern regions; it being, he remarked, in many almost black; he alluded, especially, to the aquatic mammalia, which fell most under his observation, and such is literally the case in them. I have since observed the same fact to obtain scarcely less in the diving birds; and it is, perhaps, occasioned by the slow return of the venous blood to the heart, during frequent submersion, by which it probably acquires a superabundance, or an extra quantity of carbon. In ourselves, it may be added, that the same appearance of the blood is produced, by artificially arresting its progress in the veins; and that which is slowly drawn from the arm, is, on the same principle, much darker than that which flows freely; a circumstance, even to the present day, often erroneously attributed to a morbid state of that fluid.

I shall now endeavour to describe to you another interesting peculiarity in the whale tribes. Beneath their smooth skins, the bodies of these animals are well known to be surrounded by an enormously thick membrane, which contains a prodigious quantity of fluid oil. This fluid oil, in like manner, pervades every part of the substance of their bones, which, unlike those of quadrupeds, are not hollow, but entirely spongy or cellular.

The blubber, or membrane, which contains the oil, varies in the common whale, in its depth; it is two feet thick in several situations, especially across the back of the neck; but it even extends to three feet in thickness in the lip, near the angle of the mouth. It is comparatively the most abundant, and the oil is of the finest quality in young whales; hence, a sucking whale of nineteen feet long, and fourteen in circumference, has been known to yield six tons of oil, although its whalebone was not one foot in length, and far too short to enable it to catch food. In young whales, also, the blubber is almost white; in others it is found of a yellowish colour, and in some, apparently from their partaking of a peculiar kind of nourishment, it acquires almost the red appearance of the flesh of the salmon.

The blubber may, I think, be considered as a less dense portion of the true skin, consisting, in fact, as I have often seen at Hull, of a strong tendinous membrane, whose fibres interweave each other in every direction, and which contain the oil within them; but, when deprived of the oil, these fibres appear like an irregular network of tendon, differing in the fineness of its texture in different situations; it being most compact, where it is nearest to the surface of the body,

and decreasing in its density as it dips downwards towards the muscles. In striking the back of the whale, therefore, the harpoon is plunged obliquely into this powerful tendinous network, which generally holds it so firmly, that I believe it is almost as common for the well tempered iron to be broken, as to be withdrawn; but, in destroying the creature, I may add, that its most mortal part, where the lances are afterwards applied, is a little below, and posterior to the origin of the fin, where the heart and the larger vessels are situated.

The greatest supply of oil, yielded by a single whale, of which I have been enabled to obtain a well authenticated account, was the enormous quantity of one hundred and seventeen butts, or about forty-three tons, which was removed from a whale, struck by a person of the name of Pashby, who was harpooner to the Fanny, whaler, of Hull; and as the blubber is supposed to weigh about one-third of the whole, we here contemplate an animal body weighing no less than one hundred and twenty-nine tons.

Another whale, struck by a harpooner, from whom I received the account, yielded ninety-seven butts of blubber, and had whalebone which measured thirteen feet and a half in length, which is the length of the specimens of whalebone now before us; forty butts of oil, however, are considered a good average produce.

The necessity for this wonderful provision in the Greenland whale, to which I have last adverted, the abundance of its oil, is rendered more apparent, when it is known that the real specific gravity of the muscles of this creature is rather greater than that of the muscles of quadrupeds; but, by means of its oil, so nicely is its body balanced in the surrounding fluid, that it scarcely exceeds the specific gravity of the water. But this prodigious quantity of oil not only thus materially decreases its specific gravity, in which capacity it has been aptly compared to a cork-jacket, but it seems to have been intended as the most perfect of all the various kinds of clothing, with which the mammalia have been gifted; for, being a very bad conductor away of heat, it thus preserves the warm bodies of the whale kind from becoming chilled by the low temperature of the surrounding fluid. In diving birds, it is no less interesting to observe, that the same admirable precaution is had recourse to, though in fishes whose bodies have naturally a low temperature, this being unnecessary, the oil is differently employed, and serves other interesting purposes in their economy.

But the blubber further assists, by its elasticity, in preserving the smoothness and rotundity of the body of the whale kind, which animals, as we see, have not only been deprived of external ears, or of other external appendages, which would tend to impede their rapid progression, but even the mammæ, instead of assuming their usual prominent form, are so flattened and extended beneath the skin, as scarcely to elevate the surface; and on the same principle, the testes never descend from the lumbar region.

I must now direct your attention to the very remarkable exterior clothing of the whale. It is, in the first place, a curious fact, and

one which is, perhaps, peculiar to the tribe, that those parts of the skin which are exterior to the blubber, in a young whale, are twice as thick as they are found to be in the adult, having measured an inch and three-quarters in thickness.

Now these parts are generally called, from the analogy of their position only, I conceive, the cuticle, and the rete mucosum; to preserve which supposed analogy, anatomists are obliged to describe the rete mucosum of the whale as being three-quarters of an inch in thickness. But after a careful examination of the recent skin of cetaceous animals, I cannot help believing that there is no analogy whatsoever between this substance called rete mucosum, in whales, and that of terrestrial quadrupeds. It appears to me to be a substance of a nature as peculiar to itself as that of whalebone, or of ivory; and it is here, perhaps, destined to fulfil as peculiar a part in the animal economy, as those substances. It is of a dark colour throughout; it takes its origin from the outer surface, and, consequently, from the most dense portion of the true skin; it is of a subcorneous texture, and consists of a dense congeries of parallel vertical filaments, having a great degree of elasticity. Immediately beneath the inferior surface of this substance, there is a black slimy fluid, which is easily separated, and which is, perhaps, the only vestige of rete mucosum; and this substance is covered, externally, with a thin, smooth, black cuticle, which is easily split into detached horizontal laminæ.

The whale, then, has the blubber, which I consider to be the true skin and the cellular membrane united; a very indistinct rete mucosum; and, above this, a firm elastic substance, resembling a second cuticle, with vertical fibres; and which is itself covered by a common cuticle, having horizontal laminæ.

Whether this substance, just noticed, possesses sensation or otherwise, I have not been enabled to determine, but I could perceive no nervous filaments, or blood-vessels, to enter its structure, either in that of the whale or sea unicorn, when placed under a high magnifying power; it is, therefore, probably, insensible. The blubber, on the contrary, or the true skin, from its vascular and nervous organization, is, doubtless, highly endowed with sensibility. Thus constructed, the skin of the whale is, as before mentioned, peculiarly soft, smooth, and flexible; and although, as Mr. Scoresby has observed, the pressure to which it is liable, in the depths of the ocean, is sufficient to force water through the pores of the hardest wood, yet its inherent qualities render it impermeable to the action of that fluid. All these parts of the external clothing are so pervaded with oil, that the latter affords nourishment to several species of small marine animals, which are generally found adhering to the skin; and in those parts of the seas where whales abound, an oily exudation floats on the surface of the water.

On such a scale of dimensions has the Creator been pleased to construct the Greenland whale, that I have myself seen jaw-bones of this animal, which have measured twenty feet in length; what is called a double oyster-barrel, appears to me to convey the most ac-

curate idea of the size of some of its vertebræ. Its tongue, which is of an oval form, is sufficiently large to fill four butts, when cut into pieces, or to weigh two tons, and to yield one hundred and twenty-six gallons of oil. Of so enormous a size are its lips, and so much do they abound in blubber, that one alone has afforded sufficient of the latter to yield four butts, or two tons of pure oil; and you are aware that the body of this creature acquires from fifty to seventy feet in length.

The velocity of motion possessed by so huge a body as that of the common whale, has always been a source of astonishment; but it is sufficiently obvious, that, having been destined to inhabit depths so profound, and so far removed from the air it breathes, this velocity of motion was a condition necessary to its existence.

It, however, very materially increases the danger attendant on its capture, from the awful accident of a coil of the line of the descending struck whale, entangling itself around any part of the body of the manager of the line, while it is run out; for, as the animal descends at the rate of from thirteen to fifteen feet per second, in this case, the individual so entangled becomes immediately dragged to a depth from which he is never able again to rise to the surface; and thus managers of the line are sometimes snatched from boats with such instantaneous velocity, as to almost escape the notice of all present.

That this species of whale is naturally very timid, is apparent from various circumstances. From the excessive fear into which it is thrown by the infliction of a wound, when reposing on the surface of the sea, it has, on several occasions, been known to descend with such incautious velocity, as to even fracture its massive jaw-bones, and occasion its death, by striking itself against rocks at the bottom. Nevertheless, when urged to resentment, which, as in all other animals, is most readily excited when under the powerful influence of parental attachment, the whale not unfrequently exhibits fatal illustrations of its tremendous muscular force. Thus, with the posterior half of its body quickly elevated above the water, it is enabled, with its broad semilunar tail, which has been seen to measure twenty-six feet in breadth, and one and a half in thickness, to instantaneously shatter to pieces a strong boat by a single blow. I have been assured by captain Beadling, on whose word I have great reason fully to rely, that having once wounded a large whale, it instantly elevated its tail high above one of the boats, and struck it with such force as to completely cleave it asunder transversely: the men it contained, by leaping into the water, were, nevertheless, all fortunately saved by a second boat. There is a poor crippled object now living at Hull, who was shown to me by Dr. Alderson; he was formerly a boat steerer of the Diana, commanded by captain Clifford, in which employment, a whale that was struck, ran out all the lines, and at a blow, clove the boat asunder, breaking the thigh, hip, leg, arm, three ribs, and the lower jaw of this poor man; and afterwards, almost miraculously, dragged the extremity of the boat, in which he lay, seven leagues along the surface of the water, without sinking,

within an hour and three-quarters; when he was picked up by the Dundee of Dundee. This is, however, evidently, a yet more interesting illustration of the curative efforts of the system, in our own species, than even of the powers of offence in the whale.

Another, and, perhaps, still more generally fatal mode of retaliation had recourse to by a wounded whale, especially if it be accompanied by a young one, although fortunately one of less frequent occurrence, consists in the creature tilting furiously, and with impetuous velocity, with the snout against a boat, by which the latter becomes inevitably shivered to pieces and lost. When in the agonies of death also, by the rolling motion which a whale often assumes, such blows have frequently been communicated to boats, by its widely extended fins, as to shiver them to pieces.

The extreme fidelity of these wonderful animals towards each other, and their affection for their offspring, is almost incredible. So fondly attached are they to the society of their brethren, that many instances are recorded of their assuming a passive floating position on the surface, after offering much resistance; as though disdaining to survive the loss of their companions. Thus, when the Cyrus had captured six, out of a herd of seven whales, and they were supported around the vessel on the water, the surviving one rose, and thrust its head amongst its dead brethren, and remained immoveable, close to the vessel, while it was killed.

In general, the female is accompanied in her progress by her young one, though, on the contrary, she sometimes wanders very far from it; and yet, by some unknown impulse, highly calculated to excite our amazement, she has no difficulty in finding it, though perfectly silent, in the vast and trackless ocean, as often as she requires; and the same may be said of all the cetacea. But further, when her young one is hardest pursued and harpooned, she supports it under her fin, while she plunges with it for safety into unfathomable depths.

A young whale, having been struck by a harpoon from a Hull vessel, being at the time at some distance from its mother, had run out some length of line, when the latter appeared in sight, and rapidly bent her course towards it. In vain did she use every usual means to induce it to leave the place of danger, while swimming by its side, as far as the line would allow, in circles around the boats, during the space of four hours; and within this time, on four separate occasions, the parent was observed, when on the surface, to throw one of her fins over the body of the young whale, and to endeavour to drag it away by all the force she possessed; she, lastly, in this way set off with it, in a straight direction, carrying away additional line, to the extent of seven hundred and twenty fathoms; but by that time, the young one became so much exhausted from loss of blood, that she necessarily abandoned it to its fate, and herself escaped, by pursuing her progress towards the ice, roaring and spouting with great vehemence; for here I may observe, that when a whale is struck with a harpoon, or is enraged by the loss of its young, it ejects the water through its spiracles with great force, producing a

stridulous kind of roaring, which may be heard the distance of a mile.

This species of whale affords to us a sublime instance of contrivance, compensating its total want of teeth. I allude to the hundreds of plates of whalebone, which cover the roof of its mouth, and which, by their growth, increasing in length and in breadth, often acquire twelve feet in length, and fifteen inches broad. There have, indeed, been some instances in which whalebone has attained fifteen feet in length; I believe there is at present a specimen of this kind in the Tower, which was obtained by a London vessel, and, doubtless, from a whale of enormous growth; since those whales, which afford whalebone of twelve feet, are themselves often more than sixty feet in length. The upper surface of the skull of a whale of this size, measured twenty feet eight inches long; and the creature itself weighed upwards of a hundred tons.

The roots of the two sides of the arch of whalebone, in the mouth of this animal, nearly meet at the top of the roof whence they grow, at the anterior part of the mouth; but they gradually recede from each other, as they are continued backwards, till they approach the throat, when they again approximate. This substance, called whalebone, which thus supplies the place of teeth, consists of a peculiar kind of horn. Its plates differ in their length and strength, in different parts of the mouth, but the outer row of plates are by far the strongest and the longest, especially those which are midway between the throat and the snout. Internally, supposing ourselves to be placed beneath the roof, and regarding it from below, from the lower edges of the outer plates, (those which they enclose becoming shorter and shorter, as their origin is more internal, or nearer the centre of the roof,) we see the lower edges of all uniting to form one inclining plane, extending obliquely upwards to the roof. And, as the fibres of every plate are loose and separate at its inferior edge, forming a deep pendent fringe, by the gradual splitting away of its substance in proportion as it is used, we perceive the entire vaulted sides of the roof of the mouth to be, in fact, by these means, deeply lined with a clothing of thick and coarse hair, whence the ancients gave to this species of whale, the name of Mysticetus.

Now, beneath this vault of hair, lies the enormous tongue of the whale, and exterior to it, is the immensely high lower lip, which, when the jaws are closed, shuts up over all externally to the very origin of the whalebone above, so as to entirely conceal it from view. By means also of this formation of the lip, and the circumstance of the upper jaw shutting into a cartilaginous groove at the extremity of the lower one, the most perfect valve is formed, which any pressure from without, only tends to render more secure from the ingress of the water.

The fringe, which I before mentioned, produced by the whalebone, (as it is constantly and gradually extending itself in length, by the growth of the whalebone behind it, in proportion as it is worn away,) is thus always in a proper state of adaptation to the marvellous economy of the creature; for the most curious part of this beautiful

mechanism is the net or sieve which it thus forms; an instrument which has been granted to this largest of creatures, for the purpose of straining or separating its minute prey from the body of water necessarily taken into the mouth with it, in feeding. For, in this whale, the mouth is of such enormous proportions, as to receive at once, even tons of water, and yet of such wonderful perfection is its filtering mechanism through these hair-like filaments, that it rarely allows the escape of the nourishing particles diffused therein, although they be no larger than peas; its food consisting chiefly of small medusæ, crustacea, and zoophytes. [*Quarterly Journ.*

[TO BE CONTINUED.]

On the Means of preserving Birds for Cabinets of Natural History. *By* CHARLES WATERTON, ESQ.

Abstracted from "Wanderings in South America."

WERE you to pay as much attention to birds, as the sculptor does to the human frame, you would immediately see, on entering a museum, that the specimens are not well done.

This remark will not be thought severe, when you reflect that, that which once was a bird, has probably been stretched, stuffed, stiffened, and wired by the hand of a common clown. Consider, likewise, how the plumage must have been disordered, by too much stretching or drying, and perhaps sullied, or at least deranged, by the pressure of a coarse and heavy hand,—plumage which, ere life had fled from within it, was accustomed to be touched by nothing rougher than the dew of heaven, and the pure and gentle breath of air.

In dissecting, three things are necessary to ensure success, viz. a penknife, a hand not coarse or clumsy, and practice. The first will furnish you with the means, the second will enable you to dissect, and the third cause you to dissect well. These may be called the mere mechanical requisites.

In stuffing, you require cotton, a needle and thread, a little stick the size of a common knitting-needle, glass eyes, a solution of corrosive sublimate, and any kind of a common temporary box, to hold the specimen. These, also, may go under the same denomination as the former; but if you wish to excel in the art—if you wish to be in ornithology, what Angelo was in sculpture, you must apply to profound study, and your own genius, to assist you.—And these may be called the scientific requisites.

You must have a complete knowledge of ornithological anatomy.—You must pay close attention to the form and attitude of the bird, and know exactly the proportion each curve, or extension, or contraction, or expansion of any particular part, bears to the rest of the body. In a word, you must possess Promethean boldness, and bring down fire and animation, as it were, into your preserved specimen.

Repair to the haunts of birds, on plains and mountains, forests,

swamps, and lakes, and give up your time to examine the economy of the different orders of birds.

Then you will place your eagle in attitude commanding, the same as Nelson stood in, in the day of battle, on the Victory's quarter-deck. Your pie will seem crafty, and just ready to take flight, as though fearful of being surprised in some mischievous plunder. Your sparrow will retain its wonted pertness, by means of placing his tail a little elevated, and giving a moderate arch to his neck. Your vulture will show his sluggish habits, by having his body nearly parallel to the earth; his wings somewhat drooping, and their extremities under the tail, instead of above it,—expressive of ignoble indolence.

You will observe how beautifully the feathers of a bird are arranged, one falling over the other in nicest order; and that where this charming harmony is interrupted, the defect, though not noticed by an ordinary spectator, will appear immediately to the eye of a naturalist. Thus a bird not wounded, and in perfect feather, must be procured, if possible; for the loss of feathers can seldom be made good; and where the deficiency is great, all the skill of the artist will avail him little, in his attempt to conceal the defect; because, in order to hide it, he must contract the skin, bring down the upper feathers, and shove in the lower ones, which would throw all the surrounding parts into contortion.

You will also observe, that the whole of the skin does not produce feathers, and that it is very tender where the feathers do not grow. The bare parts are admirably formed for expansion about the throat and stomach; and they fit into the different cavities of the body at the wings, shoulders, rump, and thighs, with wonderful exactness; so that in stuffing the bird, if you make an even rotund surface of the skin, where these cavities existed, in lieu of reforming them, all symmetry, order, and proportion are lost for ever.

You must lay it down as an absolute rule, that the bird is to be entirely skinned, otherwise, you can never succeed in forming a true and pleasing specimen; you will allow this to be just, after reflecting a moment on the nature of the fleshy parts and tendons, which are often left in; first, they require to be well seasoned with aromatic spices; secondly, they must be put into the oven to dry; thirdly, the heat of the fire, and the tendency all cured flesh has to shrink and become hard, render the specimen withered, distorted, and too small; fourthly, the inside then becomes like a ham, or any other dried meat; ere long the insects claim it as their own; the feathers begin to drop off, and you have the hideous spectacle of death in ragged plumage.

Wire is of no manner of use, but, on the contrary, a great nuisance; for where it is introduced, a disagreeable stiffness and derangement of symmetry follow.

The head and neck can be placed in any attitude, the body supported, the wings closed, extended, or elevated, the tail depressed, raised, or expanded, the thighs set horizontally or obliquely, without any aid from wire.—Cotton will effect all this.

A very small proportion of the skull bone, say, from the fore part of the eyes to the bill, is to be left in; though even this is not absolutely necessary; part of the wing bones, the jaw bones, and half of the thigh bones remain; every thing else, flesh, fat, eyes, bones, brains, and tendons are all to be taken away.

While dissecting, it will be of use to keep in mind, that in taking off the skin, by means of your finger and a little knife, you must try to shove it, in lieu of pulling it, lest you stretch it.

That you must press as lightly as possible on the bird, and every now and then take a view of it, to see that the feathers, &c. are all right.

That when you come to the head, you must take care that the body of the skin rests on your knee; for if you allow it to dangle from your hand, its own weight will stretch it too much.

That throughout the whole of the operation, as fast as you detach the skin from the body, you must put cotton immediately between the body and it; and this will effectually prevent any fat, blood, or moisture, from coming in contact with the plumage. Here it may be observed, that on the belly you find an inner skin, which keeps the bowels in their place. By a nice operation with the knife you can cut through the outer skin, and leave the inner skin whole. Attention to this, will render your work very clean; so that with a little care in other parts, you may skin a bird without even soiling your finger ends.

As you seldom can get a bird without shooting it, a line or two on this head will be necessary. If the bird be still alive, press it hard with your finger and thumb, just behind the wings, and it will soon expire; carry it by the legs, and then the body being reversed, the blood cannot escape down the plumage through the shot holes. As blood will often have issued out before you have laid hold of the bird, find out the shot holes by dividing the feathers with your fingers, and blowing on them, and then with your penknife or the leaf of a tree, carefully remove the clotted blood, and put a little cotton on the hole; if, after all, the plumage have not escaped the marks of blood, or, if it have imbibed slime from the ground, wash the part in water without soap, and keep gently agitating the feathers with your fingers, till they are quite dry; were you to wash them, and leave them to dry by themselves, they would have a very mean and shrivelled appearance. In the act of skinning a bird, you must either have it upon a table, or upon your knee; probably you will prefer your knee; because, when you cross one knee over the other, and have the bird upon the uppermost, you can raise it to your eye, or lower it, at pleasure.

With these precautionary hints in mind, we will now proceed to dissect a bird.—Suppose we take a hawk.—We will put close by us, a little bottle of the solution of corrosive sublimate in alcohol; also a stick, like a common knitting needle, and a handful or two of cotton;—now fill the mouth and nostrils of the bird with cotton, and place it upon your knee, on its back, with its head pointing to your left shoulder: take hold of the knife with your two first fingers and

thumb, the edge upwards; you must not keep the knife perpendicular to the body of the bird; because, were you to hold it so, you would cut the inner skin of the belly, and thus let the bowels out: to avoid this, let your knife be parallel to the body, and then you will divide the outer skin with great ease.

Begin on the belly below the breast bone, and cut down the middle quite to the vent: this done, put the bird in any convenient position, and separate the skin from the body, till you get at the middle joint of the thigh; cut it through, and do nothing more there at present, except introducing cotton all the way on that side, from the vent to the breast-bone;—do exactly the same on the opposite side.

Now place the bird perpendicularly, its breast resting on your knee, with its back towards you: separate the skin from the body on each side at the vent, and never mind, at present, the part from the vent to the root of the tail; bend the tail gently down to the back, and while your finger and thumb are keeping down the detached parts of the skin on each side of the vent, cut quite across and deep, till you see the back-bone, near the oil-gland, at the root of the tail; sever the back-bone at the joint, and then you have all the root of the tail, together with the oil-gland dissected from the body.—Apply plenty of cotton.

After this, seize the end of the back-bone with your finger and thumb; and now you can hold up the bird clear of your knee, and turn it round and round, as occasion requires: while you are holding it thus, contrive, with the help of your other hand and knife, by cutting and shoving, to get the skin pushed up, till you come to where the wing joins on to the body.

Forget not to apply cotton; cut this joint through; do the same at the other wing, add cotton, and gently push the skin over the head; cut out the roots of the ears, which lie very deep in the head, and continue skinning till you reach the middle of the eye, and after this nothing difficult intervenes, to prevent your arriving at the root of the bill.

When this is effected, cut away the body, leaving a bit of the skull, just as much as will reach to the fore part of the eye; clean well the jaw bones, fasten a little cotton at the end of your stick, dip it into the solution, and touch the skull and corresponding part of the skin, as you cannot well get to those places afterwards. From the time of pushing the skin over the head, you are supposed to have had the bird resting upon your knee; keep it there still, and, with great caution and tenderness, return the head through the inverted skin, and when you see the beak appearing, pull it very gently till the head comes out, unruffled and unstained.

You may now take the cotton out of the mouth, cut away all the remaining flesh at the palate, and whatever may have remained at the under jaw. Here is now before you the skin, without loss of any feathers, and all the flesh, fat, and unclean bones out of it, except the middle joint of the wings, one bone of the thighs, and the fleshy root of the tail. The extreme point of the wing is very small, and has no flesh on it, comparatively speaking, so that it requires

no attention, except touching it with the solution, from the outside. Take all the flesh from the remaining joint of the wing, and tie a thread of about four inches long to the end of it; touch all with the solution, and put the wing bone back into its place. In baring this bone, you must by no means pull the skin, you would tear it to pieces beyond all doubt, for the ends of the long feathers are attached to the bone itself; you must push off the skin with your thumb nail and fore finger. Now skin the thigh quite to the knee, cut away all flesh and tendons, and leave the bone; form an artificial thigh round it with cotton, apply the solution, and draw back the skin over the artificial thigh;—the same to the other thigh.

Lastly, proceed to the tail; take out the inside of the oil-gland, remove all the remaining flesh from the root, till you see the ends of the tail feathers, give it the solution, and replace it. Now take out all the cotton which you have been putting into the body from time to time to preserve the feathers from grease and stains. Place the bird upon you knee on its back, tie together the two threads which you had fastened to the end of the wing joints, leaving exactly the same space betwixt them as your knowledge in anatomy informs you existed there when the bird was entire; hold the skin open with your finger and thumb, and apply the solution to every part of the inside; neglect the head and neck at present; they are to receive it afterwards.

Fill the body moderately with cotton, lest the feathers on the body should be injured whilst you are about the following operation. You must recollect that half the thigh, or in other words, one joint of the thigh bone, has been cut away; now, as this bone never moved perpendicularly to the body, but, on the contrary, in an oblique direction, of course, as soon as it is cut off, the remaining part of the thigh and leg, having nothing now to support them obliquely, must naturally fall to their perpendicular. Hence the reason why the legs appear considerably too long. To correct this, take your needle and thread, fasten the end round the bone inside, and then push the needle through the skin just opposite to it; look on the outside, and after finding the needle amongst the feathers, tack up the thigh under the wing with several strong stitches; this will shorten the thigh, and render it quite capable of supporting the weight of the body without the help of wire; this done, take out every bit of cotton, except the artificial thighs, and adjust the wing bones (which are connected by the thread) in the most even manner possible, so that one joint does not appear to lie lower than the other; for unless they are quite equal, the wings themselves will be unequal when you come to put them into their proper attitude.

Here, then, rests the shell of the poor hawk, ready to receive from your skill and judgment, the size, the shape, the features, and expression it had, ere death and your dissecting hand brought it to its present still and formless state. When the heart ceases to beat, and the blood no longer courses through the veins, the features collapse, and the whole frame seems to shrink within itself. If, then, you have formed your idea of the real appearance of the bird from a

dead specimen, you will be in error. With this in mind, and at the same time forming your specimen a trifle larger than life, to make up for what it will lose in drying, you will re-produce a bird that will please you.

[TO BE CONTINUED.]

ENGLISH PATENTS.

To BENJAMIN RIDER, *Hat Tip Manufacturer, for his invention of certain improvements in the manufacture of Hat Tips, which he intends to denominate Rider's Patent Hat Tips.* Enrolled January, 1829.

THE subject of this patent is a new compounded material, intended principally to be employed for making the circular tips, by which the crowns of hats are stiffened and kept in their proper shape. The hat tips, as they are commonly called, have, heretofore, been made of pasteboard, or card, or some such substance, susceptible of imbibing damp, which is considered to be objectionable. The improved hat tip is made of materials impervious to water, and, therefore, possess the advantage of resisting damp. The particulars are as follow:—

Specification.—"My invention of certain improvements in the manufacture of hat tips, consists in the constructing or making of a new material, or substances, composed of some of the articles from which brown paper is commonly made, combined with cork in a pulverized or granulated state, which material, when manufactured into sheets or boards, something resembling millboards, is particularly calculated for hat tips, and may be also applied to a variety of other useful purposes.

"In preparing this new material, I take of the pulp or felted fibrous vegetable matters, of which brown, or whitey brown paper is commonly made, about seventy-five pounds, when in a dry state, and having worked this in the mill, or vat, as paper makers usually do, I then add about thirty-five pounds of pulverized, or granulated cork, which is to be so perfectly mixed or blended with the pulp in the mill, or vat, as to form one compound substance. These proportions of quantity may, however, be slightly varied, without materially altering the articles intended to be produced. This substance is then to be moulded, either by hand or machinery, in the same way that sheets of brown paper, or millboards, are commonly made, carrying it through the usual operations of couching, pressing, and drying.

"This material, when thus made, being finished, is a sort of compound of cork and paper, the sheets of which are to be cut into circular pieces for the tips of hats; but I do not propose to sell it at all times in that form, but in sheets to be cut at pleasure to the dimensions required by hat-makers. In some cases, I coat the mate-

rial on one or both sides of its surface with varnish, of the kind commonly employed by hat-makers for stiffening the shells or foundations of hats.

"This material may be applied to making the entire body of the hat, either by moulding it from the vat to the proper shape, or by cutting the sheets, and joining their edges together with cement. It may also be applied to various other purposes, such as hat boxes, muff boxes, and other boxes and envelopes for preserving packed goods from damp; and in some cases, where it may be desirable to prevent the ravages of moths, I mix with the above materials in the vat, a small quantity of pulverized cedar wood. It may be necessary to add, that the cork or the cedar wood must be reduced by grinding it in a ginger mill, or between stones in a flour mill; but I do not confine myself to any particular machine for grinding, but pulverize it in any, or the best way, that circumstances may dictate.

[*London Journal.*

To William John Dowding, *Clothier, for his invention of certain improvements in machinery for Rolling, or Rollering Wool from the Carding Engine.* Enrolled January, 1828.

In order to understand the subject of this patent, it is necessary to explain that part of the operation of preparing and spinning wool to which it applies.

The filaments of wool having been separated, and in a sort of way combed out and brought into a thin sheet or sliver, by the ordinary scribbling or carding engine, that thin sheet or sliver of wool is further operated upon by an extension of the carding engine, and is ultimately discharged therefrom, by the doffer comb striking off small portions of the sliver of wool from the fillets of cards on the doffer cylinder, in breadths of about six inches, and in horizontal lengths of about thirty inches, which is the ordinary width of the cylinders of the carding engine.

These portions of wool are conducted by the doffer comb into a semi-cylindrical box, or trough, at the end of the carding engine, in which a fluted roller revolves; and these flutes taking hold of each doffed portion of the wool, as it descends into the trough, rubs it round, and rolls it into the form of a round rod, called a roll, or roller of wool, and delivers it out of the trough, on to a traversing table, or endless cloth.

Thus a rapid succession of rolls, or rollers of wool, are turned out of the engine in horizontal lengths, which are carried by children to the slubbing machine, or billy, in which the slubbing, or first process of spinning, is effected.

The mode of feeding the billy, or slubbing machine, with wool, is, by placing the rolls, or rollers, side by side, in longitudinal directions upon an endless feeding cloth, inclined upwards, which is mounted on rollers at the front of the billy; and this feeding cloth

being made to traverse, carries forward the rollers of wool towards the spindles, advancing so much at every stretch, or traverse of the carriage, in which the spindles are mounted, as is necessary to supply to each spindle the portion of wool required to be extended and spun into the roving, or first condition of loose twisted yarn.

Now, as the rollers of wool discharged from the carding engine, are not more than about thirty inches in length, it is necessary that they should be frequently supplied to the machine, and the extremities of the fresh rolls carefully joined to the ends of the preceding rolls. This is done by children, who constantly attend the machines, carrying the rolls of wool from the carding engine, and joining them to those in the slubbing machine. But this joining of the ends of the rolls of wool is attended with inconvenience, as if too much of the end of one roll overlaps the end of the other, the yarn or roving drawn from it will be gouty, or irregularly thick in parts; or, if the junction of the two ends is not sufficiently perfect, the yarn or roving will be in some parts too thin, and, probably, break in stretching. Such, however, is at present the universal practice in preparing roving of wool; and to obviate this inconvenience, is the object of the present patent.

The improved apparatus is to be attached to a carding engine, which is to be of the ordinary construction, with the exception of the form in which the wire cards are to be placed upon the doffer cylinder. Instead of fillets of wire card, about six inches broad, extending the whole length of the cylinder in the direction of its axis, it is proposed to place the cards in rings around the periphery of the cylinder, and by means of the doffer comb, to strike off the wool in continuous strips or ribands of sliver, which are to be received on to an endless traversing table, or cloth. The edges of the rings of wire are to be guarded by rings of stout leather; but this part of the apparatus is not claimed as new.

The novelty in the apparatus consists in placing another similar endless traversing cloth upon that which receives the strips, or ribands of sliver, so that the sliver may be carried forward from the carding engine, between the two cloths; and while they are thus conducting it, a lateral motion is given to the upper cloth, which causes the strip, or riband of sliver, to be rolled up from its previously flat form, into that of a round rod or roller.

This plan of producing endless rollers of wool from the carding engine, by means of the lateral motion given to the endless cloth or other surfaces, between which the sliver may be conducted and rubbed, is claimed as a principle, by whatever modification of machinery it is effected.

The mode described in the specification, is, by mounting the upper endless cloth upon rollers, and giving it the same progressive motion as the lower cloth, by means of pullies and cords in the ordinary way; the rollers of the upper cloth being mounted in a carriage upon small wheels, which, by means of a rotary crank and connecting rod, is made to traverse to and fro in lateral directions, in which

lateral movements the sliver becomes rolled up by the friction of the two surfaces of cloth.

In order to take a sufficient quantity of wool from the carding engine, it is proposed that two or more doffer cylinders should be employed in connexion with the large carding cylinder; and of course, that the rings of cards on one should be opposite to the blank spaces on the other. In this case, the doffer cylinders must be one above the other, and separate endless traversing cloths, mounted in the way described, adapted to receive the sliver from each doffer cylinder. From the endless cloths, the rollers of wool will fall in continuous lengths into boxes, cans, or other receptacles below; and from these cans, or other receptacles, when placed in front of the billy, the rollers of wool may be afterwards drawn, as required, to supply the spindles of the machine, in preparing the rovings, without the inconvenience of joining the short rollers together by the hands of children, as above described. [*Ib.*

To Thomas Stirling, *for certain improvements in Filtering Apparatus.* Enrolled February, 1829.

One of the leading features of this invention, appears to be the construction of vessels which are to be employed for filtering water for domestic uses, by combining slabs of slate; and the other is passing the water upwards, in a zigzag course, through layers or beds of sand, and other purifying matters.

These slabs of slate are to be cemented together at the joints, by a mixture of white lead, or a strong mortar made of lime; and the slabs are to be further supported and braced together to prevent their separating, by rods of iron passed through the vessel, and secured by nuts screwed on the outsides.

The form of the vessel is proposed to be square, or at least rectangular, and about twice as high as the breadth of the base, the internal part being divided into five compartments, by gratings or perforated plates.

The water is to be introduced into the lowest compartment, by a pipe leading from a reservoir, placed in an elevated situation, in order that the pressure from above may cause the water to rise through the filterer to the top.

The lowest compartment, or receiving vessel, is covered by a grating, upon which, occupying the second compartment, a quantity of sand is placed. The water is, therefore, to percolate through the sand upward, and deposit any foul matter with which it may be impregnated in the bed of sand.

Above the second compartment, a plate is fixed, with conical holes in the centre, through which the water is made to pass, by the upward pressure, into the third compartment, which is likewise filled with sand. The plate above this third compartment, is perforated towards one side only, so that the water, in passing upwards, has to proceed through the bed of sand, partly in a horizontal direction.

The fourth compartment is occupied with sand and carbonaceous matter, such as broken pieces of charcoal, or burnt brick, or unglazed pottery ware, which not only takes up the foul matter mechanically, but also acts chemically upon the water, to sweeten and purify it from any putrid animal matter which it may contain. The plate above the compartment is perforated with conical holes towards the opposite side to the lower plate, for the purpose, as before stated, of causing the water to percolate through the bed, partly in a horizontal direction, and by thus giving it a zigzag course, to bring it in contact with a more extended bed of the purifying material than it would be exposed to if it passed directly upwards.

The fifth compartment contains broken pieces of slag from the Carron foundry; (we presume any other iron foundry would do as well;) and from this compartment, which is at the top of the filtering vessel, the purified water is to be drawn off for use.

In constructing a filtering apparatus of large capacity, it is proposed to make its sides with brick, or in some cases with iron, properly secured together. [*Ib.*

To Samuel Pratt, *Camp Equipage Maker, for his invention of certain improvements on elastic beds, cushions, seats, pads, and other articles of that kind.* Sealed June 25, 1828.

The patentee says, my invention "consists in a new method of making or manufacturing elastic beds, cushions, and other such articles constructed with wire springs, by which I afford a greater degree of elasticity, and avoid the inconvenience which has been heretofore experienced from the hard edges of wood framing, which I now dispense with.

"In constructing these beds, cushions, pillows, or seats for carriages, settees, coaches, chairs, or any other article of domestic use, requiring an elastic cushion, I first provide a sheet of canvass or sail cloth, or any other flexible material suited to that purpose, as a basis on which the springs are to be attached. This cloth I strengthen, by placing ribs of whalebone and cane, or any other elastic material, round its edges, or round the form of the intended bed or cushion, and also across it in different directions, on both sides of the canvass or sail cloth, and sew them together at the junction, and to the cloth. The breadth and length of the basis sheet, must depend upon the intended dimensions of the bed or cushion, whether for one or two persons to lie upon, or merely as a seat, cushion, or pillow; and the strength of the springs must be varied accordingly, as a greater or less degree of resistance may be required.

"This foundation sheet may be made from various materials. I sometimes use mill board, but I prefer it to be perfectly flexible; and, therefore, in common, employ the sail cloth or canvass, and whalebone or cane, as above described. Stout leather would answer

the purpose, or thin slips of whalebone, or cane, woven into a lattice work. A variety of other articles will also apply to this use, therefore I do not confine myself to any peculiar material, but employ any flexible materials that may be found most advantageous and convenient of adaptation, to constitute the basis or foundation sheet, upon which the wire springs are to be fixed.

"Having prepared the stiff foundation sheet, as above described, and spread it out flat, I next take a number of spiral springs, made of iron or steel wire, twisted into circular coils, in the shape of an hour glass, or, what is still better, springs made of wire bent into angles, instead of circular coils. I have adopted a triangular form, but square, or any other angular figure, would, perhaps, answer nearly as well, provided the coils of the wire are so disposed, that being depressed, the coils will fall one within the other.

"The foundation sheet being spread out flat, as above stated, any number of the springs may be placed upon it, at short distances apart; the number of the springs employed in making one bed, or cushion, and also their necessary strength, must depend upon the size and required elasticity, for which no decided rule can be given, but it may be readily known by a very little experience.

"The lower coil of each spring is to be fastened by sewing, or otherwise, to the foundation sheet, and to the whalebone bracing; and when they are all secured in this way, they are further confined by pack thread, or other small string, tied to the top coils, and extended diagonally from one to the other, bracing them all together.

"On the tops of the springs thus secured to the foundation sheet, and braced together, I extend another sheet of canvass like the former, strengthened with ribs of whalebone and cane, as described above; and having sewed it to the upper coils of the springs, in the same way that the lower coils were secured to the foundation sheet, I then raise up the flaps, or overhanging edges of the canvass, or sail cloth, of the lower sheet, and sew it all round to the top sheet, and then the flaps of the top sheet to the edges of the bottom, enclosing the springs on all sides as a box.

"The internal part of the bed, or cushion, having been thus constructed, it is to be padded on the outside with wool, horse hair, or other elastic material, as stuffed seats are usually made; and upon this I put the canvass and ticking, cloth, leather, silk, or any other material, which is to constitute the external covering of the bed, cushion, pillow, or seat.

"In making small pillows and cushions, I sometimes pass one-half of each coiled spring through the foundation sheet, and secure it by sewing the sheet to the two central coils of wire. The outer coils of the springs, both above and below, are then tied together in the way above explained, and a sheet of canvass covered over the whole, which is sewed to the outer coils of the springs; and when the seams are sewed up, so as to enclose the springs, the necessary paddings of horse hair, or wool, are laid on, and the cushion covered with canvass ticking, leather, silk, or any other suitable material, accord-

ing to the will of the purchaser, or the purpose for which the pillow or cushion is intended to be used." [*Ib.*

To James Stokes, *Merchant, for certain improvements in Making, Boiling, Curing, Clarifying, or Preparing, Raw or Muscovado Sugar, Bastard Sugar, and Molasses.* Dated October 11, 1827.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said James Stokes, do hereby describe the nature of my said invention, and in what manner the same is to be performed and carried into effect, by the following description thereof, (that is to say:)—

First, the liquor, or cane juice, being taken into the clarifier, I take to it about fourteen pounds of charcoal, about seven pounds of bark of the wild elm tree, and about one pound of lime, and proceed to clear the liquor, take off the scum, &c. in the usual way, and when sufficiently clear, I pass it through a blanket into a clarifying cistern or other vessel, and pump it, or otherwise convey it into the pans or teaches, for the purpose of boiling or evaporation. The liquor being boiled to the proper proof, is passed into the coolers, according to the well known method, or may be potted in moulds, according to the practice of sugar refiners: but previous to its being taken into the hogsheads, I take it into boxes, or vessels constructed for that purpose, the dimensions of which I regulate according to circumstances, and mix with the sugar, brandy, geneva, rum, or any other spirit or spirits, in the proportion of about one gallon to every hundred weight of sugar; I then submit it to the action of an hydraulic, or other press of adequate power, which forces out the moisture, and leaves the sugar sufficiently dry to put into the hogsheads, and much improved in quality and colour.

Or, secondly, I take raw sugar, or bastard sugar, in its finished or manufactured state, and when boiled by this, or any other method, and putting it into boxes as above mentioned, proceed to mix, press, &c., in the manner as before described, and producing the same effect.

And I do declare that the articles and quantities mentioned, are most conducive to the said results; but I claim the privilege of varying the quantities, or apparatus, as may be necessary, and of introducing any other article or articles of similar chemical powers and affinity.

[*Repertory of Patent Inventions.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN APRIL, 1829.

With Remarks and Exemplifications, by the Editor.

1. For machinery for *Steering Ships and other vessels;* Michael Pearson, Newburyport, Massachusetts, April 1.

The rudder head has a short tiller, projecting from it in the usual way. Within this tiller there is a metal nut to receive a screw of three threads, with which the vessel is to be steered. The screw revolves in stanchions, fixed upon the deck, in front of the rudder head. On one end of the screw, which is of iron, and about three feet long, a steering wheel is fixed; so that this part forms a wheel and axle. The screw passes through the nut in the tiller; which nut slides backwards and forwards in a groove, and swivels upon pins, like a compass box. This is the whole arrangement.

To us the plan appears to be inferior to some already in use, on several accounts; particularly, as it seems impossible to put the helm hard up. If steering with a screw in this way, is found to be eligible, we apprehend that a toothed segment on the rudder head, would be far preferable to the sliding nut.

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2. For a machine called the "*Straw Cutter and Wheat Thrasher;*" Levi Rice, Lockport, Niagara county, New York, April 1.

A trough is made like that of the ordinary straw cutting machine; in this, the straw to be cut or thrashed is placed, and carried towards one end, by a feeding cloth upon revolving rollers; a drum or cylinder, of from one to two feet in diameter, and from two to four feet in length, according to the width of the trough, to which its length must be equal, is made to revolve rapidly: the axis of this cylinder stands parallel to the end of the trough, and its periphery nearly touching it. When cutting is to be effected, knives reaching from end to end of the cylinder, are fixed at suitable distances upon it, and cut the straw as it is drawn forward; an iron or steel bar across the end of the trough sustaining it, and re-acting against the knives.

When wheat, &c., is to be thrashed, the cylinder with knives is removed, and one having beaters, formed of bars about an inch square, is substituted. These beaters form ridges upon, and extend from end to end of the cylinder. Upon the shaft or axis of the cylinder, a heavy fly wheel may be placed, "which *accelerates* the motion of the cylinder." When used for thrashing, screens, a winnower, &c. are appended, to operate in the usual manner.

"The two operations by the one machine, your petitioner claims to be the sole inventor of. He also claims to be the sole inventor of the machine for cutting straw; and he also claims to be an improver on the machine for thrashing, by the application of the balance wheel, and the application of the screen and winnower."

Excepting in extraordinary cases, we intend hereafter to present the outlines of thrashing and washing machines, without making unwelcome reflections and invidious comparisons; as, were we freely to tell our thoughts in all instances, we are apprehensive that their projectors would frequently be inclined to try the operation of *lathering*, *thrashing*, and *beating* upon ourselves; and as, our intentions being always good, we should deprecate such a consummation,

we are determined to pursue a prudent course, and avoid exciting the ire of the testy corps of inventors.

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3. For a new and improved *Machine for making Pails, Tubs, Buckets,* and all kinds of cooper work; Nathaniel Rider, Sturbridge, Worcester county, Massachusetts, April 1.

There are in this specification many parts named, which appear essential to the operation of the machine; but which are neither described or figured. Were we, therefore, to give the drawing and the whole specification, we apprehend that it would still be obscure; a general idea of *what* the machine is to do, may be obtained from the claim of the patentee, to wit: "The application of the circular saw to saw hoops out of boards or planks; (and, also, an upright saw, may answer the same purpose;) also, the gang of saws for matching the staves; the hoop saw and bit, for boring and rounding the ear staves to pails; the concave jointer, that smooths and rounds the outside of the vessel; the convex jointer, that planes the inside of the vessel; and, also, the above described method of making the bottom of any kind of vessel, and heads of casks."

A model of the machinery has not yet been delivered into the patent office, or we might be able to give a better account of the apparatus employed. This might benefit the public, but would be of no avail to the patentee, as the description must be made perfect, by means of the specification and drawings. Models are required for the sake of those who visit the office, to see what has been patented, but, however perfect they may be, they constitute no part of the description, or proof, of what has been patented.

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4. For a *Washing Machine;* John Taylor, Amherst, Hillsborough county, New Hampshire, April 1.

This differs considerably from most of the washing machines which we recollect to have seen. A box, or trough, is made to hold the water and the clothes; across one end of this box, five or more rollers are placed, turning freely on their axes; these stand one above the other, either vertically, or forming a concave towards the body of the trough; against these, the clothes are to be pressed, by means of a carriage running backward and forward within the trough. This carriage traverses upon wheels or rollers; the front of it, or that part which is toward the rollers, is formed of square bars of wood, usually eight in number; these retire back, so as to give to that part of the carriage the form of a step-ladder; the lower step may pass up to the line of the rollers, when the upper one will recede to a considerable distance, as the retiring steps form an angle of about 45° with the horizon.

This carriage is worked backwards and forwards, by means of a bent lever attached to it, and working upon a pin towards the back end of the trough, beyond which it projects, and is actuated like a pump handle: between the rollers, and the bars, which form the front of the carriage, spaces are left to allow the soap-suds to pass freely.

"The box should be about half filled with water, or lixivium, for washing. Then, as many clothes as on experience shall be found convenient, are to be put into the machine. The lever should then be moved with a moderate motion. When the end is depressed, the lower bar will be brought near to the lower roller; in doing this, the clothes will rise upon or against the rollers, which readily turn on their gudgeons, and facilitate the rising of the clothes. When the bars recede, the top part of the clothes will fall over, and on the return of the bars, the lower ones will come first in contact with the clothes fallen over. By repeating this, each part of the clothes will, in turn, be pressed by each part of the bars and rollers, and with a small portion of the time and labour bestowed in the modes hitherto in use, the clothes will be perfectly cleansed."

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5. For an improvement in the *Rotary Temples for Weaving*, for which a patent was obtained by the present patentee, on the 7th of June, 1816; Ira Draper, Saugus, Massachusetts, April 1.

The temples originally patented, consisted of wheels with oblique teeth, which were screwed firmly upon the breast beam. When the beater struck the filling, there being no elasticity in the temples, they were rapidly worn, and their points made holes in the edges of the cloth. In the improved mode, a wooden spring fastened by its centre to the breast beam, extends across the loom, to each edge of the cloth, and upon this the temples are fixed: there are some other improvements in the mode of adjusting them, and causing the points to leave the cloth readily; but to explain these would require the drawings.

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6. For an improvement in *Locks for securing Doors*, and for other similar purposes; Truman Bartholomew, New York, April 3.

This lock is intended as an economical substitute for the mortise lock, for parlour and bed room doors. In it, the common sliding or spring bolt, is made to answer its ordinary purpose, and also, to serve as a key bolt. A spring bolt is made of sufficient strength for the purpose intended, and a mortise is made in the edge of the door to receive this, and allow it to play freely. A brass plate for the bolt to play through, is let into the edge of the door, where it is to be screwed firmly. The inner end of the bolt may pass through a thin plate, which may be let into the door, by making a small mortise in the rail for that purpose. The bolt is to be forced out by a spiral spring, to receive which, there is a mortise, or slot, made through the bolt, just within the edge of the door; a piece of metal plate, being passed through the door, and also through this mortise, for the back end of the spring to bear against, whilst the other presses out the bolt: or the spiral spring might be put on the far end of the bolt, and bear against the bottom of the mortise.

Two knobs, with screw shanks, are screwed into the bolt, one on each side of the door, in which mortises are made for that purpose; or one only may be used. When there are two, the piece of metal, for

the back end of the bolt to slide in, may be omitted, as the shanks of the knobs, and the plates upon which they are to slide, will fulfil this intention. These knobs, it will be seen, are not to turn, but to be pushed back, like that of the old fashioned street door lock.—As a spring bolt, the fixture is now complete; but, to make it answer the purpose of a lock, a small one, similar to those used for drawers, is let in from one side of the door, so that its bolt may stand directly under (or above) the edge of the spring bolt. A notch is filed in the edge of the spring bolt, to receive the bolt of this small lock, which thus secures it in its place. A second notch may likewise be made to retain the spring bolt entirely within the door.

An escutcheon is used, sufficiently large to cover the opening where this lock is let in. By this contrivance, a small key answers for room doors, and the whole cost will be less than that of the ordinary lock.

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7. For an improvement in the *Art of building Chimnies,* and altering those already built, in such manner as to prevent, or cure, their smoking; A. H. Read, Montrose, Susquehanna county, Pennsylvania, April 3.

(See specification.)

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8. For an improvement in the manufacture of *Coffee Mills;* James Carrington, Wallingford, Connecticut, April 3.

This mill, as the patentee acknowledges, is similar in its form and structure to those formerly patented by Waterhouse, and improved by Wilson. The difference, indeed, is very small, so as really to leave it a matter of doubt, whether there is ground enough upon which to erect a secure patent.

In the former mills, the back was of wood, and the hopper of sheet iron; in the present they are both of cast iron, which change of material is claimed as making a part of the present patent. There is also a collet or washer for the regulating screw, as will be seen by the general claim.

"I do not claim as my invention, the shell and runner, nor any part of Waterhouse's coffee mill, or of Wilson's improved mill, as made before my invention, and now in common use; but I claim as my invention, and as very important improvements on both, the cast iron plate and hopper, and the collet in the plate in aid of the thumb-screw, to regulate the machine. By means of the friction piece, or collet, that screw will hold its place, and not yield to the motion of the crank, or be subject to wear by friction; and the runner, having a more extensive bearing, will run more true, perform its work more perfectly, be less liable to get out of order, and the whole machine being thus made of iron, not only assumes a more elegant form, but is free from shrinking, warping, and other effect of weather; and is in fact much stronger, more durable, and, with the aid of the collet, more exact in its operation."

The fact is, this coffee mill is a very excellent and neat article, and as its cost is probably about the same with the old one, its neatness and durability will be sufficient to recommend it, without appealing to the circuit court for their decision respecting its novelty.

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9. For an improvement in the *Cotton Gin;* David Phillips, Jefferson county, Mississippi, April 3.

The improvement claimed, is in the form of the breast board, and the addition of a press board attached to the upper end of the grate frame.

The breast board is a plain straight board, standing vertically, or nearly so, the lower edge being placed nearer to the cylinder than in the ordinary gin, so as to contract the horizontal diameter of the roll of seed cotton, causing it to press less upon the seed vent, and more upon the centre of the saws.

The press board consists of a narrow strip of wood, about 3 inches wide, extending the whole length of the roll, and pressing lightly upon it; the board is hinged to the top of the grate frame: this renders the roll more compact, and prevents its raising up.

The whole contrivance is extremely simple, but the patentee avers that it offers several advantages, requiring less power, and ginning nearly one-fourth more cotton than usual in a given time, and much more perfectly than by the old mode.

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10. For an improvement in the *Saw Mill,* by which the same saw gate is made with equal facility to carry one, or any number of saws, at one time, as wished; Peter Tomlinson, Derby, New Haven county, Connecticut, April 3.

The principal improvement claimed, is in the manner of making the saw frame, and fixing and tightening the saws. The saw frame is made to run with but little friction in the grooves of the fender posts, by using plates of iron or steel.

The girths of the saw frame, instead of being supported at their ends, have studs, which are placed within, as near to the saws as the log to be cut will admit. These are made moveable, for the purpose of shifting the saws, &c.

Suppose a number of saws to be run, say seven, the holes by which they are to be straightened are made to correspond perfectly, so that when laid upon each other, one bolt would pass through the whole of them; this is an essential point, as it is by such bolts that the saws are to be strained. The centre saw has a split stirrup, both above and below; the top stirrup being tightened by nuts.

When this saw is placed within the slits in the stirrups, the bar or bolt is passed through the holes; other saws, without stirrup irons, are then slipped on at each side; then again saws with stirrups, and afterwards without, when the whole seven will be in their places. Two narrow stirrups are to be placed after the last pair of saws. As the saws move freely, laterally on the bolts, their distances apart may be regulated, and altered with great facility. When the nuts

are tightened, all the saws will be strained. Notched braces extending from stud to stud, may retain the saws at their proper distances, or blocks of wood, perfectly true and hard, may be fixed in between them.

There are some other improvements claimed, such as a particular mode of attaching the pitman to the bottom of the saw frame, and the mode of regulating the feed. As these are minor points, we shall not lengthen out our description by further explanation.

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11. For a new *Marine Rail-way;* Daniel Rogers, Mobile, Alabama, April 3, 1829.

The main objects proposed in this rail-way, are,—1st, the rollers employed are not made to depend upon their gudgeons, but roll upon the ground rail, being merely confined in their places by their gudgeons; and 2ndly, there being lateral or cross rails, on either side of the main rail-way, for the purpose of receiving a vessel, so that a second or a third may be drawn up. The parts are not clearly explained, either in the description or by means of the drawings.

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12. For an improved *Razor Strap;* Gooding Halloway, Chester, Butler county, Ohio, April 3.

Emery, crocus, Prussian blue, *Prussian* vermilion, and a proper adhesive composition, form the materials with which the four sides of the strap are to be covered. Although we perceive nothing new in the composition, or substances, superior to what has been repeatedly effected in the mode of application, we know that a good strap may be made from these substances, if properly prepared and applied. The particular recipe, agreeably to the rule adopted by us, we do not publish.

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13. For using the Salts or Alcalies, obtained from the spent ley of soap makers, as a flux in the *Manufacture of Glass;* George H. Burgin, Philadelphia, April 3.

The specification states, that "The manner of using the salts, or alcalies, obtained from the spent ley of soap makers, in the manufacture of window glass, and common glass hollow ware, as bottles, vials, &c. is to combine it with silex and caustic lime; when what is called flint glass is to be made, the oxides of lead, and (excepting alcalies,) the other materials usually employed in the manufacturing of that article, are to be added." The mode of procedure, generally, being the same as that heretofore practised. The quantities used must be determined by experience, or by testing, by proper reagents, the composition of the particular mass of salts, or alcalies about to be employed.

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14. For a Machine for *Sawing down Trees,* sawing off logs, &c. by a "Portable horse-sawing machine;" David Pierce, Poughkeepsie, Dutchess county, New York, April 3.

The description of this machinery occupies ten pages. The proposition is, to apply to the purposes proposed in the title of the patent, either a circular or straight saw, which is to be moved by horse power. Bars, dogs, blocks, pullies, an endless rope, chains, &c. &c. have to be fixed to the tree, or log, and also to some permanent or fixed object at a distance. The mode of doing this would not be easily described in words, nor indeed, is it very well shown in the drawing. The complexity of the apparatus, and several other considerations, render the utility of it very doubtful. The patentee claims "the manner of conveying the rectilinear, or alternating circular, motion of a horse or other quadruped, into an alternating circular motion in a pulley or wheel, by a rope, band, or chain, and applying the same to a circular saw; and also, carrying this motion through an alternating circular motion in the pulley or wheel, and applying it to a saw, moving the saw in an alternating rectilinear direction."

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15. For an improvement in the *Gun Lock*, by reducing the number of component parts, changing them from a vertical, to a horizontal movement, and making the whole more simple, strong and durable; Ephraim Gilbert, Rochester, Monroe county, New York, April 3.

As there is much novelty in this lock, we intend hereafter to give an engraving of its principal parts, without which, it cannot be perfectly understood.

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16. For a Mill, or Machinery for Cleaning Rice, and other grain, being an improvement on the mode of pounding with pestles moved with cranks, invented by Roswell King, and for which a patent was obtained by him, Nov. 21, 1809; John Ravenel, Charleston, South Carolina, April 8.

On the 17th May, 1828, Mr. Ravenel obtained a patent for a mortar for cleaning rice. The bottom of this mortar was solid, but the sides were composed of wove wire, supported by ribs; this formed a sieve, which allowed the flour, or dust, which is formed in the pounding, to escape; which dust, in the ordinary mortar, causes the materials to heat, and greatly retards the operation. In the present patent, these mortars are used, but it is proposed to move the pestles by cranks, which will prevent their approaching too near the bottom of the mortar, so as to break the rice: this plan had been patented by Mr. King. Mr. Ravenel's improvement consists in the addition of a fly wheel to regulate the motion, and in the mode of adjusting and placing the mortars under the pestles, so that either may be removed without disturbing the remainder.

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17. For an *improvement in the Can Spinner*, for which a patent was obtained Nov. 25th, 1828; John Thorp, Providence, Rhode Island, April 3, 1829.

This will appear with Mr. Thorp's other improvements, a part of which are in the present number.

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18. For new applications, or improvements, in the art of *Making Cut Nails by Machinery*, being improvements on a machine, for which letters patent were issued to Jesse Reed, in the year 1807. Also, for a new invention, or application, of a new method of feeding nail machines, by machinery, where the plate is turned; Thomas Odiorne, Malden, Massachusetts, April 3.

(See specification.)

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19. For an improvement in the manner of *Dressing Millstones;* David Philips, Jefferson county, Mississippi, May 3.

"The principle of this improvement, consists of the form and arrangement of the lands and the furrows of the stones; the arrangement consisting of the greatest possible number of furrows, directed from the periphery of the stone towards the eye. The general surface of the stones are perfectly plane, having no dish or bosom, as in the common stone. The furrows consist of two sets; those which, with their branches, lead from the eye to the periphery, and those which rise in the intervening lands, and run to the periphery: the former diminish in their width and depth, as they proceed outwards; the latter increase in their width and depth, as they proceed outwards. The form of the furrows, as to their depth, may be nearly a half circle. The lands between the furrows, as they approach the eye of the stone, should contain no more surface than is necessary to give them sufficient strength, and should increase in surface as they pass outward."

The upper and lower stones are similar. The claim is to the arrangement of the furrows.

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20. For *Spectacles with Spiral Springs;* Samuel Babcock, Middletown, Middlesex county, Connecticut, April 3.

The main feature of this invention is, the giving to the temple, or side piece, one, or more, spiral turns, close to the joint of the eye frame. For this purpose the side piece is made of round wire. This gives much greater elasticity than the ordinary mode, and the same degree of strength in a lighter article.

The joint is put immediately on the extremities of the bezel, instead of extending it on an end piece in the usual way. The joint pin is a screw, answering the purpose of confining the glass, as well as that of a pivot.

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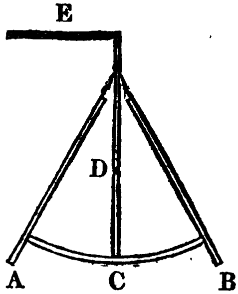
21. For a *Machine for Blowing*, called Triangular Bellows; William Sidney Jack, New York, April 4, 1829.



The diagram may give an idea of the construction of these bellows. The sides A, B, and the bottom C, form the case of the bellows. The flap D, in the inside, is worked by the lever E; the flap is secured at the top by leathering. In each side, there is a valve opening inward, to admit air, and from each side, a pipe proceeds to convey the wind. How the flap is to be made air-tight at its edges, is not stated, nor is there any particular claim.

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22. For a *City Rail-road Carriage;* John L. Sullivan, Civil Engineer, Philadelphia, April 6.

The object of this invention is to obviate the difficulty of removing the loading from the Rail-road carriage, in order to transport it from the termination of the rail-road, in a city, through its various streets.

For the mode in which this is to be accomplished, we refer to p. 237 of our last volume, where Mr. Sullivan has fully described it, in his communication on the subject of the "Baltimore rail-road carriage."

The claim is, to "the enabling of Rail-way carriages to leave the rail-way, and traverse streets and roads, by aid of the mechanical means aforesaid, whereby they may be drawn, guided, and conducted to any special destination, like other carriages; by the variable obliquity, thus temporarily given to the forward, or auxiliary, axle of the rail-road carriage."

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23. For *Double Rack and Twin Wheels, and Quarter Section Wheels, as applied to Steam Engines,* and other power machinery, where a rotary motion is required from a reciprocating, eccentric, or irregular motion; Joseph Woodhull, Rochester, Monroe county, New York, April 6.

The specification describes various modes of dispensing with the crank motion in steam engines, by using a frame with teeth on the inside, for wheels, or sections of wheels, to work in, both in the ascending and descending stroke of the piston.

We have had previous occasions to remark upon similar plans, as the object above proposed has been pursued by a number of inventors, who have thrown away much ingenuity in devising their schemes, and expended large sums in their execution. We do not think it necessary to describe the particular modes patented by Mr. Woodhull. He has at least twenty predecessors among patentees, and many hundreds among inventors. Several of the schemes have shown great skill, but we think that in these cases, skill has been applied to the getting rid of a simple, excellent, and perfect action,

to adopt one which is complex and useless. We, in common with the great body of mechanicians, believe the crank motion to be the best which can be devised, for receiving the power from the piston rod, and gradually arresting the momentum of the vibrating mass of matter in the beam and its appendages.

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24. For a composition of matter, to be used in the *Fusion, Refining, and Working of Metals and Ores;* Henry B. Chew, and E. V. Freeman, Baltimore, Maryland, April 7.

The mode of refining metals, proposed by the patentees, is, the use of a flux, into the composition of which gum copal and several saline ingredients enter. To us the composition appears to be altogether inartificial; and as the salts used are incompatible, or such as must decompose each other, a flux might readily be made of articles apparently very different from these, whilst they would be essentially the same.

It is averred, that experience has shown that the advantages resulting from the use of this composition, in fusing, refining, forging, and welding, are very considerable; and if this be the fact, our theory must stand in the back-ground. Without permission from the patentees, we do not publish their process.

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25. For an improvement in the *Saw Mill;* George Brown, Deerfield, Oneida county, New York, April 7.

This improvement consists in forming a tongue on the saw gate, and grooves on the fender posts, by bolting on cast iron, or any suitable metal.—That's all.

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26. For *Propelling by means of Weights,* carriages, boats, mills, and in general for attaining all those objects which are at present effected by steam, animal, or water power; Milton F. Colburn, Baltimore, Maryland, April 7.

This is one of those disguised perpetual motions, which serve to deceive none but the merest tyro in mechanical knowledge, and which yet deceive numbers. One man is successively to raise a number of weights, all of which, in descending, are to operate upon a barrel common to the whole of them. Suppose there are ten weights of 50 lbs. each, nine of these are to be acting, whilst the tenth is being raised, and they are all, of course, to act with their whole power. The specification states, "that the labour of a single man, can suffice to keep an immense weight in constant action:" we, however, are very apprehensive, that it would require a man with a *large* family, in order that he might station one stout fellow at each weight.

Most of our readers will excuse us from publishing the particular structure of this machine, whilst those who wish to know all about it, may do so by applying at the patent office.

27. For machinery, which, when put in operation by steam, he denominates "*The Curved-tube Rotary Steam Engine*," and when put in operation by water, "*The Curved-tube Rotary Water Wheel*;" Elijah Bryan, New York, April 8.

This engine and water wheel, are to act precisely upon the principle of Barker's mill; in one case, steam, in the other, water, are to be the actuating agents. When steam is used, a hollow axis is to proceed from a boiler; upon this axis, a wheel is to be fitted like the wheel upon the axis of a carriage. The rim of this wheel is to be made heavy, so as to form a fly wheel; the parts which resemble spokes, are curved hollow tubes, open at both ends. They are usually bent, so as to reach the rim on the side opposite to that from which they issue from the hub; an opening, or openings, made in the hollow axis, admits steam into each of the curved tubes; and this, by the force with which it rushes out, is to give a direct rotary motion. The wheels of carriages are to be similarly constructed; as also are the proposed water wheels.

The patentee calculates that such an engine will not only be simple in its parts, but operate with great force. 'A boiler, of the high pressure kind, is *preferred*.' We are very apprehensive, that with one really of the low pressure kind, his wheels would stand still. In principle, this machine is precisely the same as some of the whirling globes, or wheels, exhibited in different histories of the steam engine, and which mark the infancy of this herculean instrument. Our calculations are egregiously faulty, or the patentee is altogether wrong in his anticipations.

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28. For a machine, or *Carriage for the Removal of Heavy Buildings;* Ephraim Bowen, Ledyard, Cayuga county, New York, April 9.

Stout truck-wheels are made to turn on strong axes. The front axes has two diverging pieces mortised into it, so as to stand out like hounds. The ends of these hounds are connected together by a curved piece of timber, a hole in the axle being the centre of the curve; through which hole the king bolt passes, which is to confine a piece of timber that is to operate as a tongue; the tongue may be bolted to any part of the curved piece which connects the hounds, so that it may stand either straight out, or obliquely, from the axle, to determine the direction of the wheels. By this tongue, or 'saddle-sill,' the draft is to be made. Mortises are also made in the truck-wheels, to move them on, if required, by means of '*a new application of the lever to the wheels!*' which, however, is not described, unless the following was intended as a description of this *new* application. "Into low carriage wheels, consisting of four or more pairs, mortises are made in any convenient number, to admit the ends of levers, (or handspikes,) and the carriage, (with the building on it,) is moved by the successive application of these levers."

29. For the application of *Friction-Wheels to the Axles of Rail-road Carriages*, or Wagons; Henry B. Chew, Baltimore, Maryland, April 9.

The patentee admits the fact of friction-wheels, or rollers, having been long used to the axles of carriages, and rests his claim upon his particular mode of applying them. The carriage wheels consist of a rim and two sides, so as to form a hollow box; through openings in the centre of these sides, the axis is to pass. This axis is to be surrounded with friction-wheels, which lie within the box, their axes running in holes in the casings which form the sides. Small friction rollers, it is said, may surround the axes of these friction-wheels, &c. &c.

The objections to this plan, which immediately present themselves to us, are, its complexity, and its being no better than others which are much more simple. For the rest, we have heretofore expressed our opinions on the application of friction rollers, and have no inclination to go again over the same ground.

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30. For an improvement in the manner of *Making Axes;* John Alley, Sen., Franklin county, Indiana, April 9.

The only novelty, if novelty it be, claimed by this 'inventor, or discoverer,' is, the taking a piece of iron sufficiently large for an axe, and punching it through for the eye, so that the whole may be made with no other welding, than that of the steel for the cutting edge: he says,—"What I claim to be my particular discovery or improvement, and which I wish secured by letters patent of the United States, is the opening of the eye through the solid bar of iron, and then making the axe without the necessity of welding any part, unless it be that of welding in the steel."

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31. For an improvement in the mule for spinning threads, or yarns of cotton, wool, or other substances, called "*The Improved Self-operating Mule;*" Ira and Aden Gay, Dunstable, Hillsborough county, New Hampshire, April 10.

The machinery for which a patent has been obtained under the above title, is very clearly described in the specification, and delineated in the drawings; but it would be in vain to attempt to make it understood in words only. What is claimed is plainly indicated in the specification, but does not stand alone; the following extracts, however, will show the object of the invention.

"Our invention is easily added to any of the mule heads heretofore in common use, and being so added, the mule completes the spinning of the thread and building of the cop, requiring no mule spinner. When once so adjusted as to make the stretch, and return the thread, precisely as it is done by the best mule spinner in his happiest efforts, it will constantly repeat that operation with unerring certainty. And our improved mule is managed with as little trouble as the spinning frame, by girls only, who have little to do beside

piecing the threads and changing the bobbins. The construction of our machinery is for making the cop, not on the naked spindle, but on a bobbin."

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32. For an improvement on Mordant's *Ever Pointed Pencil Case;* Joseph Saxton, Philadelphia, April 11.

An accident prevents our immediate examination of the specification of this patent, and we do not recollect the particulars respecting it; we know, however, that a part of the improvement consists in the retraction of the point of the pencil within the case, by turning its sheath in a reversed direction. We will give the whole hereafter.

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33. For an improvement in the *Manufacturing of Salt,* for which a patent was obtained on the 13th day of January, 1829, but subsequently surrendered to correct a defective specification, nd re-issued April 11, 1829.

(For an abstract of this patent, see specification.)

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34. For *Carding and Sorting Wool* at the same time, by means of a Double Doffer, applied to a single or double breaking wool carding machine; John Boynton, South Coventry, Tolland county, Connecticut, April 11.

An additional doffer, fully covered with cards, is applied to the finishing cylinder; its office is to take from this cylinder all the coarsest wool, leaving the finest to be removed by the ordinary doffer placed under it. "The coarse parts of wool, the fibres of which are stiff and bristly, stand out on the cylinder above that which is of a finer and softer quality, and as the cylinder revolves, the coarser parts of the wool which lie uppermost on the cylinder, are received upon the new, or additional doffer." The remainder is removed by the lower doffer. The distance of the doffer is to be adjusted by screws.

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35. For an *Iron Mill;* John W. Post, of Washington, D. C., and Calvin Post, of Springport, Cayuga county, New York, April 11.

(See specification.)

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36. For a machine for *Manufacturing Wrought Nails, Rivets, &c.;* Samuel G. Reynolds, Bristol, Rhode Island, April 13.

This is an ingeniously constructed machine, which is said to answer its intention perfectly, and specimens of the nails deposited in the patent office appear to justify the assertion. The machine is, of course, complex, but does not appear to be more so than is necessary for the various operations to be performed. The nails when made, are wedge-formed, being as wide at the point as close up to the head,

like cut nails; they, however, need not be made of a regular taper like the latter, unless this form be preferred. The rods from which the nails are to be made, are heated in a tube within a furnace, just opposite to the feeding part of the machine. It is received between cheeks which determine the width of the nail. Whilst between the cheeks the rod is operated on by a roller, filed on its periphery into long narrow teeth, adapted to the wedge-form of the nail. The cutting off, gripping, and heading, are then performed, the apparatus for which could only be described, satisfactorily, by means of drawings.

There have been previous patents for machines for manufacturing wrought nails, one of which bears a considerable resemblance to the present, particularly in the structure of the cheeks, and the mode of giving the taper to the nail.

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37. For an improvement in the manner of *Mortising and Making Tenons*, on the ends of the spokes of wheels, pannel work, cabinet work, joinery, &c.; Luther Davis, Northampton, Hampshire county, Massachusetts, April 14.

The plan proposed is to make round tenons, by means of a *hollow auger*, which will form the tenon by boring. Two or three such tenons may be formed side by side, and corresponding holes be bored to form the mortise. When spokes of wheels are to be put into cast iron hubs, the holes are to be cast larger at the bottom than at the top, the mortise split, and a wedge loosely entered, which, in driving the spoke, will spread the tenon, and cause it to hold firmly.

No particular claim is made. Instruments similar to the hollow auger have been in use from a remote period, and as no particular structure, or indeed any structure, of the auger is described, the patent, of course, is not for this; for what it is, we must leave others to determine.

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38. For a mode of making or *Manufacturing Dressing Combs of Wood;* Nathaniel Bushnell, Middletown, Middlesex county, Connecticut, April 14.

The combs described are to be made in two pieces; the blade part has the grain running in the direction of the teeth; this is to be let into a grooved back, which runs the whole length of the comb, and is to be finished rounding, like the ordinary quill back comb.

"This invention, or improvement, consists in the forming the back of a comb in a separate piece, or of separate pieces of wood, so fastened to the back of the comb blade, as that the grain of the timber will run at right angles with the grain of the wood, forming the comb blade and comb teeth."

By this means a dressing comb may be made of wood, of the same shape and size as one made of horn, and much cheaper.

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39. For a machine for *Cleaning and Dressing Hemp or Flax;* Amos Salisbury, Troy, New York, April 15

This machine consists principally of four skeletons of cylinders, the axes of which stand parallel to each other, and lines uniting these would form the four angles of a rectangle. These axes are about three feet in length, and at each end have six arms extending about eight inches from the centre. A bar of iron, half an inch in diameter, extends from the end of each arm to that opposite to it, and thus is formed what we have called the skeleton of a cylinder. The two upper and the two lower pair of cylinders are placed so near to each other as not to allow the arms and rods to pass, did they not each work in the spaces between the rods, or beaters, like the teeth of cog-wheels. The whole are kept in their proper places by cog-wheels on the ends of the shafts, and they all revolve inwards. The iron bars form the beaters which are to clean and dress the hemp, or flax, which is held above, and allowed to hang down between them.

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40. For a machine for *Forming Hat Bodies;* Benjamin Lapham and Eleazer Cady, Canaan, Columbia county, New York, April 15.

The specification of this machine gives a general description of the whole, without telling what is claimed as new. There is a double conical *former* for receiving the wool from the carding machine, in the same way as in several other machines. As these revolve and receive the wool, it is beaten by what are called patters, that is, strips of wood which strike upon the cones, by a rapid vibratory motion; one extending along each cone on the side opposite to that upon which it receives the wool; these serve to consolidate the body, by giving it a slight felting. These patters receive their motion from two cam-wheels. We apprehend that the patters are the improvement intended to be claimed.

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41. For an improvement on the *Printing Press,* known by the name of the Washington Press, for which a patent was granted May 11th, 1821; Samuel Rust, New York, April 17.

The Printing Press, upon which the present improvements are made, is one of the progressive lever kind, and is well known among printers. Upon the former patent, several improvements are claimed, but they are generally for matters of detail, the principle of the press remaining unchanged. A regulating screw is inserted near the curvature of the handle, to check it, and prevent its going too far back. The connecting rod attached to the bar, is also modified, and there are some new contrivances for lessening the friction, and regulating the pressure; the whole of these are claimed. In the description there is much verbiage, and, as is usual in such cases, but little clearness.

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42. For *Rail-roads, and Cars* to run thereon; James Wright, Columbia, Lancaster county, Pennsylvania, April 17.

This will appear at an early day, with engravings.

43. For a machine for *Breaking and Cleaning Hemp and Flax;* Amos Salisbury, and John C. Langdon, Troy, New York, April 18.
(See specification.)

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44. For machinery denominated "Brewster's Eclipse Speeder," for *Making Cotton Roping;* Gilbert Brewster, Poughkeepsie, Dutchess county, New York, April 18.

We can give only the claim of the patentee, as the specification is of great length, and the drawings would occupy two or three plates.

"What I claim as my discovery in said machine, is, the application of a belt, or band, of leather, or any other suitable material in the forming of a belt, or band, to be used for the twisting of cotton roping, whereby the counter twist is formed by passing the roping through between the two surfaces of a belt, or belts, or band, or bands of leather, or any other suitable material; said belt, or band, being in motion, and putting in the twist by the friction thereof."

"I also claim the application of said belt, or band, for twisting wool roping, in the same manner as used in the cotton."

[TO BE CONTINUED.]

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the art of Building Chimneys, and altering those already built, in such manner as to prevent or cure their Smoking. Granted to ALMON H. READ, *Montrose, Susquehanna county, Pennsylvania, April* 3, 1829.

SMOKE is chiefly water in a state of vapour, mixed with carburetted hydrogen, rarefied nitrogen gas, and bituminous substances. The principal part of the water is furnished by the chemical combination of the hydrogen of the combustible body, with the oxygen of the atmospheric air of the room. Hence, the absolute necessity of taking into consideration the capacity of the room, in order to determine the size of the fire-place and flue. Again, the current through the fire-place and flue, is to be kept up, not only by the gases and vapour, above mentioned, but in part by the rarefaction of atmospheric air, let into the room by the occasional opening of the doors, &c., the whole of which is not decomposed by the process of combustion, but is continually escaping in a rarefied state, with the vapour and gases. Hence, in the second place, the necessity of ascertaining the capacity of the room, i. e. the quantity of cold air to be rarefied and expanded. I have discovered the due proportion between the capacity of the room and that of the fire-place and flue.

1st. The number of cubic feet contained in the room to be warmed, must be calculated.

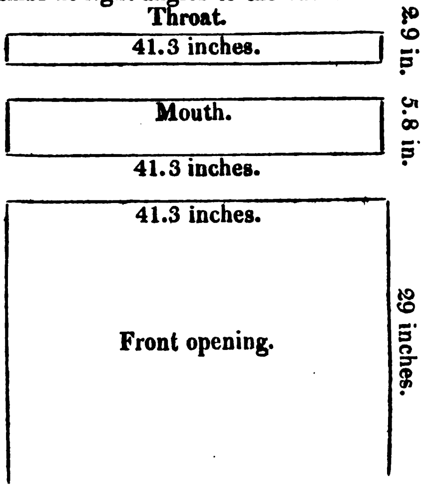
2nd. The front opening of the fire-place must contain four-tenths the number of square inches that there are cubic feet in the room.

3d. The front opening of the fire-place must not be more than seven-tenths as high as it is wide.

4th. The horizontal section at the mantel (which I call the mouth) must contain two-tenths the number of square inches contained in the front opening, and must extend the whole width of the back. 5th. The throat must contain one-tenth the number of square inches contained in the front opening, and must extend the whole width of the back. 6th. The throat must be, above the mouth, equal to one-eighth the width of the front opening. 7th. The flue above the throat must be carried out, of the same capacity of the throat, varying the direction and shape as you please, but preserving the same number of square inches in every section thereof. 8th. The flue should be carried out separate from all other flues. 9th. The two last mentioned rules are to be observed in building new chimneys, but in altering old ones, generally, may be disregarded, without essential injury. 10th. If two fire-places of equal size are wanted in the same room, take one-half of the cubic feet as the capacity of the room, and in like proportion if three or more fire-places are required. 11th. The fire-place may be deep or shallow, the back may be perpendicular or otherwise, and the jambs may be at right, or any other, angle to the back, that suits the fancy.

What I claim as new and as my own discovery, in the above described improved method of building chimneys, and for the use of which I ask an exclusive privilege, is, the *application* of the aforesaid principles to the building of chimneys, and also the first, second, third, fourth, fifth, sixth, seventh, and tenth rules or positions above mentioned. A. H. Read.

Drawing of a fire-place for a room containing three thousand cubic feet, and with jambs at right angles to the back.



Room containing 3000 cubic feet. Four-tenths of 3000 is 1200, the number of square inches in the front opening. This gives a fire-place 41.3 inches wide, and 29 inches high, with a mouth of 240 square inches, and a throat of 120 square inches, and a flue above the throat, of 120 square inches; the throat above the mouth, $5\frac{1}{8}$ inches.

Specification of a patent for new applications, or improvements, in the art of making Cut Nails by machinery, being improvements on a machine for which letters patent were issued to Jesse Reed, in the year eighteen hundred and seven. Also of the application or new method of feeding Nail Machines by Machinery, where the plate is Turned. THOMAS ODIORNE, *Malden, Massachusetts, April* 3, 1829.

THE new applications, or improvements, which I have made, on Jesse Reed's said machine, are as follows. Dispensing with several cumbrous and expensive parts of said machine, I, nearly on a level with the gripping dies, extend two solid and substantial arms from the sides of the stationary jaw, and embracing the moving jaw; and across the extreme ends of said arms, at the back of the moving jaw, I apply an eccentric arbor, so formed as, at a revolution, to give timely motion to the several parts of the machine, in the act of cutting, gripping, and heading the nail. On the back end of said arbor, I hang the balance, or fly wheel, and the pulley for the band. I hang the forcing slide box by a strip of steel attached to the back of it, and passing through a groove in the jaw behind the moving cutter, is connected to an upright axle, so that the box may play, as on a hinge. I have also varied the mortise for the stationary cutter, making it like that in the moving jaw, reversed, or open, on the back side; so that I place the cutters into each jaw alike, and secure them in like manner.

I head the nail by means of a small lever exclusively for that purpose, in a manner similar to the old way; but it receives its motion from a cam on the main arbor, while the heading set is vibrated, by another cam one way, and by means of a spring the other way.

In respect to the feeding of the machine, my invention, application, or improvement, consists, principally, in what I call a circularly vibrating rack rod, operated upon by moveable spring catches, pressed towards the cutters of the nail machine by a separate spring, which is forced back and let forward by a vibrating wedge. The means by which I effect the proper and timely motion of the above mentioned parts of the feed, are as follows. I fix upon the crank, or main arbor of the nail machine, a small pinion, matched by a cog wheel, twice its diameter, which I hang upon the gudgeons of a small crank, connected by a tie, or pitstaff, to the arm of an arbor at one end, which arbor passes through the centre of a friction wheel at

the other end, and a loose friction bar, kept in contact with the sides of said wheel by a stiff spring pressing against its centre, so that the bar moves with the wheel. At each end of this bar, I fasten a strap, and attach the other end of each, on opposite sides, to a pulley, supported by a standard, through the centre of which pulley the rack rod passes, as also through a moveable ring that holds the catches, so that as the friction bar plays back and forth, circularly, the rack rod which holds the nippers and plate, vibrates each way half round the wedge, letting the plate into the cutters, alternately. In order to afford proper time to cut the plate, when turned, I fix adjustable stops, each side the friction bar, while the friction wheel moves further on, leaving the plate at rest; which turns again on the first start of the friction wheel, either way. The lateral motion of the hand which directs the plate into the cutters, I effect by a cam, or crank, on the main arbor, giving motion to a knee, to which I fasten the hand, by pivots; or I have effected the same motion adapted to the old machine by a toggle, one end of which being attached to the main lever, the other is attached to an upright stud, to which the hand is fastened, as before stated. The rack rod and nippers, I suspend to a top bar, parallel with the rod, by a sliding tie, leading the plate into the cutters. For regulating the point of the nail, I elevate or depress the feeding apparatus by the turn of a screw nut on the top end of an upright rod, the other end of which is attached to a bar at the bottom of the standard; and I stop the feed, while the nail machine is going, with the foot on a treadle, that by means of a purchase, takes the spring off from the friction bar.

THOMAS ODIORNE.

Abstract of the specification of a patent for improvements in the Manufacture of Salt, first issued January 13*th,* 1829. *Surrendered for the purpose of amending the specification, and re-issued April* 11*th,* 1829. JEAN A. TEISSIER, *Boston, Massachusetts.*

THE specification states that the *new system* consists in making choice of a plot of even ground, the surface of which may be a little elevated on one side, to facilitate the draining of the water. It must be on a part of the sea shore covered at high tides, but where the water may be dammed out. The reservoir thus formed, is called the *water work.* A flood gate admits the water from the sea, and a canal surrounding the dam prevents the rain water from affecting the works, excepting that portion which falls directly upon them.

Pumps to be worked by wind are used within the water work, to pump the water up to the height of about thirty feet, whence it is to fall upon brushwood and branches of trees, to break it into drops, exposing a large surface to the action of the sun and air.

In winter, advantage is to be taken of removing the ice formed in the water work; the ice consisting of water nearly fresh, and the remaining water being much concentrated by the process.

The whole plot of ground is to be prepared so as to render it impervious to water; to effect this it is levelled, and divided into compartments by a mixture of *earth and clay*, well beaten down, and forming banks of about three feet in width, and one in height. A few inches of salt water is then to be admitted, which is to be allowed to mix with the earth forming the bottom and sides, previously loosened for that purpose. This water is to be allowed to dry away, the ground, as it dries, being rendered as compact as possible, by beating. A mixture of equal parts of sand, clay, and lime, is then spread over the whole, to the thickness of an inch and a half, beating it to harden it, until it becomes dry. The respective squares, or compartments, are then ready for the admission of salt water, for the intended manufacture.

This lining is said to protect the salt from the admixture of all impurities from the earth, which it always contracts from ground not so prepared, but merely lined with clay, as is usual.

A point particularly insisted upon, is, the scientific arrangement of all the parts, and the *novel* operation of pumping up the water, and allowing it to fall upon twigs and branches to promote the evaporation. We omit many minor points in the description, such as the evaporation and crystallization of the concentrated liquid, &c. The claims are, "the mode of evaporation in the concentrating basin, by raising therein the water, and letting it fall in the open air in cascades, on branches of trees, brush, or other wood." The concentration by the removal of the ice in winter. The application of the cement described, together with certain other parts which refer to the drawings.

The first claim is to a process long known and extensively used. The second has also often been taken advantage of in cold climates; and we, therefore, are apprehensive, that as these form principal items in the claim to novelty, its validity is a very questionable point.

Specification of a patent for an improvement in Spinning and Twisting; consisting of a Whirling or Rotary Ring, and a Revolving Hook, (intended to answer the purpose of the common flyer,) and the connexion of the Bobbin and Spindle. Granted to JOHN THORP, *of Providence, Rhode Island, November* 20, 1828.

A WHIRLING, or rotary ring, and a revolving hook, are used in the place of the common flyer, to keep the yarn a proper distance from the bobbin, and to guide and distribute it thereon. The ring segment, or section, or piece to which the hook is confined to hold and steady it, moves in a circular groove, or grooves, formed in a circular plate, that encompasses the bobbin. Said hook is placed where the lower extremity of the flyer, in common spinning frames, moves. The bobbins, being connected with the spindles, and moving posi-

tive therewith, drag the ring, segment, or section, or piece to which the hook is confined, causing the hook and the piece to which it is confined, to revolve in said groove, or upon a lip, or rim, projecting from, and belonging to said plate, the friction of which produces that tensive draught requisite to wind the yarn on the bobbin. The above mentioned ring may be made of small wire, the ends of which may be so doubled as to form the hook; or the hook may be made of a piece of steel, and confined to each end of the wire, or the piece of steel itself, of which the hook is formed, may be made to slide loosely around in said groove, or upon a rim or lip, and thereby dispense with the ring. The spindles have in them a collar, from which two studs, or pins, extend upward, containing a mortise, or hole, in the base of the bobbin, by which the spindle and bobbin are united, causing the bobbin to move positive with the spindle, twisting the yarn; and the yarn being placed in the hook, the hook is dragged around in said groove, and falls back of the bobbin, winding the yarn on it as fast as delivered from the rollers of the machine. The bodies of the bobbins must be half as large again as those of the common kind, and may be greatly increased in length. The plate above mentioned, in which the groove is formed, may be a *ring*, or else a hole through the plate, encompassing the spindle, through which the bobbin vibrates. The above improvement can be used in the common throstle frames, by confining said plate to what is called the bobbin, or vibrating rail; in which case the hook will rise and fall for the purpose of distributing the yarn upon the bobbin; or the plate may be attached to the spindle, or stationary rail, and if so attached, the spindles and bobbins must rise and fall for the purpose of distributing the yarn as aforesaid. It may be requisite, in some kinds of spinning, or twisting, to band the ring; in which case the plate will be unnecessary, and the rings made wide, say about an inch, and thin, and supported by friction pullies, so as to receive a band and motion from the cylinder or drum. In this case the hook is formed in the upper edge of the ring, to receive the yarn, and drag the bobbin, like the arms of the common flyer. The friction pullies are placed on studs, or pivots, which are arranged in a line, at equal distances, and are confined to either of the above mentioned rails, and are equal in number with the rings, and an additional one at the end of the row, to secure the outer ring.

In forming the score in the pullies for the bands, two projecting rims are left, one at the top and another at the bottom of said pullies, which shut into two creases, or channels, formed in the ring, one at the bottom and the other about midway of the ring, serving to steady and keep said ring in its place. The score in the ring, which is intended for the band, being between the creases, and the pressure of the band on the ring being toward the pullies, also serves to keep the ring in its place. It is, however, necessary, where the rings are large, that they should have something to steady them in front, or opposite to said pullies, which may also be friction rollers, or studs. The objects of the above improvement are to dispense with the common flyer, and obtain greater speed than the arms

of the flyer, and common operations of the bobbin will allow of, and to increase the length of the bobbins, so that a greater quantity of yarn can be spun before they require shifting, and to produce a more constant, even, and tensive draught on the yarn, than is produced in the common mode of spinning, and to render the trembling of the spindle, occasioned by wear, less injurious.

John Thorp.

References to Plate 1.

A, Fig. 1 and 2, represents the spindle and bobbin.
B, Fig. 1 and 2, a piece of the spindle, rail, and step-rail.
C, Fig. 1 and 2, a part of a stationary rail.
D, Fig. 1, a circular plate.
E, Fig. 1 and 2, a whirling, or rotary ring.
F, Fig. 1 and 2, the revolving hooks.
H, Fig. 1 and 2, the yarn.
I, Fig. 2, friction pullies.
J, Fig. 2, the band.
K, Fig. 1, the band and whorl.
L, Fig. 2, the creases, or channels, in the rotary ring.

Description of Fig. 1.

The spindle and bobbin, A, are connected by a couple of studs, or pins, extending upward from a collar on which the bobbin sets, entering a hole, or mortise, in the base of the bobbin, or it may be crowded snugly into the spindle. The rail, C, is a plate of cast-iron, having holes through it, in one of which the circular plate, D, is confined. In this last plate, is a groove, in which the rotary ring, E, is loosely placed, and allowed to revolve in said groove; to this ring, the hook F, is attached. The yarn being placed in the hook F, and the bobbin turning positive with the spindle, drags said hook and the ring, E, causing them to revolve in said groove. The friction of the hook and the piece to which it is attached, produces that tensive draught requisite to wind the yarn on the bobbin.

Description of Fig. 2.

The bobbin, A, stands loosely on the spindle, and allowed to turn on it, or the spindle turns, as the case may happen. The whirling, or rotary ring, E, has creases, or channels, in it, in which the projecting rims of the friction pullies shut, serving to steady and keep said ring in its place. The pressure of the band, J, on the ring, being toward the pullies, also serves to keep the ring in its place. Said ring receives motion from a cylinder, or drum. The hooks, F, receive the yarn, and drag the bobbin, like the arms of a common flyer. The spindle and bobbin, in both figures, must vibrate, in order to distribute the yarn over the whole length of the bobbins.

Fig. M, represents a form in which the rotary ring and hooks (in Fig. 1,) can be made of the same piece of wire.

Fig. N, ground view of said ring; it being heaviest at *c*, causes a greater centrifugal inclination at that place, equal in force to the

counteracting draught of the yarn, which is from *b* to *a;* and as the bobbin fills, the counteracting draught diminishes, and friction increases, making the draught on the yarn more equal. Increasing or diminishing the weight of the hook, increases or diminishes the draught on the yarn.

Specification of a patent for an improvement in Spinning of Filling, and Slack Twisted Yarn, called the "Can Spinner." Granted to JOHN THORP, *of Providence, Rhode Island, November* 20, 1828.

THIS improvement consists of a cup, or can, placed on the top of a dead, or still, spindle, around the surface of which the yarn revolves, being drawn by the bobbin as it twists and receives it. This cup, or can, answers the purpose of the common flyer, in keeping the yarn at a proper distance from the bobbin, and in guiding and distributing it thereon. The bobbin may be either a weaver's bobbin, or a common spinning bobbin, at the option of the manufacturer, and turns on the spindle, receiving its motion from a whorl, which also turns on the spindle, and with which it is connected at its base, by two pins, or studs, extending upward from the whorl, and entering two corresponding holes, or mortises, in the base of the bobbin, the whorl being banded gives positive motion to the bobbin. The bobbin rail is similar to the one in common use, excepting that it is made to steady the spindles by having the holes through which the spindles pass, of the same size as the spindles. It vibrates like the bobbin rail in common machines, and on it the whorl is set, obeying the motion of the rail, moving the bobbin up and down on the spindle, and spreading the yarn over the whole length of the bobbin, the lower edge of the cup, or can, being the guide. The rail to which the spindles are confined, or what may be called the spindle-rail, is a plate of cast-iron. In this rail are scores, which exactly fit the spindles, and by which, with the assistance of an eye, or clasp-bolt, they are kept perfectly steady; and by these bolts the spindles can easily be adjusted, and raised or lowered so that the lower edge of the cup, or can, which is the guide of the yarn, may suit the filling of the bobbin. The cup, or can, rests and is hung upon a shoulder at the top of the spindle, and its cavity is sufficiently large to admit the bobbin. This can be lifted off and put on again with ease. It must be taken off to change the bobbins, and to mend or piece the yarn when the bobbin is in the can. In finding broken ends, or in piecing the yarn, the bobbin is lifted by the thumb or finger, from the pins, or studs, that connect it with the whorl, and the whorl is allowed to run while the yarn is put in a proper position to be mended; then the thumb, or finger, is withdrawn from the bobbin, and it falls to its proper place, connecting itself again with the whorl. When spindles are placed close to each other, it may be necessary to surround each cup, or can, with a cylindrical, or semi-cylindrical tube,

to prevent the yarns from interfering as they pass round their respective cans. JOHN THORP.

References to Fig. 3, *Plate* 1.

A, cup, or can.

B, bobbin, which may be either a spinning bobbin or a weaver's bobbin.

C, whorl, on which the bobbin stands, and with which it is connected.

D, spindle.

E, piece of the bobbin, or vibrating, rail.

F, piece of the spindle rail.

G, band (lettered C.)

H, eye, or clasp-bolts, which secure the spindles (not lettered.)

The yarn is seen leading down from the rollers of a common spinning frame.

The can, A, rests on a shoulder at the top of the spindle, and can be taken off and put on with ease. Around the surface of this can, the yarn revolves; being drawn by the bobbin, as it twists and receives it. The lower edge of the can is perfectly smooth, and serves to guide and distribute the yarn on the bobbin.

The bobbin, B, stands on the whorl, C, and is connected with it by two pins, or studs, that extend upward from the whorl, entering a hole, or mortise, in the base of the bobbin; and the whorl, being banded, causes the bobbin to have a positive motion.

The whorl, C, sets on the bobbin, or vibrating rail, E, and turns on the spindle, moving up and down, obeying the motions of said rail, spreading the yarn over the whole length of the bobbin. The holes in the rail, E, through which the spindles pass, are of the same size with the spindles themselves; by which means they are kept steady.

The rail, F, is a stationary plate of cast-iron, to which the spindles are confined.

The bolts, H, through which the spindles pass, have a screw-nut on the backside of the rail, F, by which the spindles are drawn close to the rail, and held perfectly steady.

When the spindles are placed close to each other, it may be necessary to surround each cup, or can, with a cylindrical, or semi-cylindrical tube, to prevent the yarns from interfering as they pass round their respective cans.

Description of an improvement in spinning, called the "Ring Groove Spinner," for which a patent was granted to JOHN THORP, *of Providence, Rhode Island, December* 31, 1828.

THE drawing and references which accompany this description, render it unnecessary to give the specification at length; we, therefore, will briefly state the nature of the invention.

The common flyer is dispensed with in this improved mode of spinning, a ring being substituted for it, for the purpose of distributing the yarn upon the bobbin. The ring is sufficiently large to admit of the bobbin, with the yarn wound thereon, passing through it. Upon the surface of this ring the yarn revolves, being drawn by the bobbin as it twists, and receives it, and serving at the same time to keep the yarn at a proper distance from, and to distribute it upon, the bobbin. The ring is placed in a circular groove, in a circular plate, H, Fig. 4. This plate encompasses the bobbin, and may be made to vibrate over it by the motion of the rail to which it is attached, or the spindle and bobbin may be made to vibrate, as may be preferred. The lips that form the groove, are of a circle smaller in diameter than the ring, in order to retain it in its place. The depth of the groove is such as to allow the ring to yield to the pressure of the yarn. The ring thus fitting loosely, permits it to yield on either side, so as to allow a space for the revolving of the thread between it and the groove, whilst the friction which it sustains, causes it to wind sufficiently tight upon the bobbin.

The plate is opened on the front by a narrow saw kerf, running obliquely through it from right to left, which allows a free passage of the yarn from the outside of the plate to the ring.

The spindles differ from others only in their being shorter above their upper bearing; they have a collar on them, on which the bobbin sets, and with which it is connected by two pins, or studs, extending upward, and entering two corresponding holes in the base of the bobbin. Either a common, or weaver's, bobbin may be used, and may be readily taken off and put on to the spindle. When constructed for a weaver's bobbin, the collar on which the bobbin rests has a spiral spring under it, and when the yarn breaks it can readily be pressed down, and joined, without taking the bobbin off. When on a common spinning bobbin the yarn breaks above the plate and ring, it must be taken off, in order to mend, or piece the yarn.

The bobbin that is intended for the shuttle, has its shaft in two parts, being split nearly from point to head, which causes it to bind well when crowded on to the tongue of the shuttle.

References to Fig. 4, *Plate* 1.

A, is the bobbin-rail,
B, the spindle rail,
C, the foot rail,
} of a common spinning frame.

D, the spindle.

E, the bobbin, connected with the collar, F, by pins, or studs.

F, a collar which slides on the spindle, and is connected with it by the spiral spring, I, which being confined to the collar at the top, and to the spindle at the bottom, causes the collar and spindle to turn together.

G, a box which forms the upper bearing of the spindle, D, and in which it turns.

H, the circular plate, bolted to the rail, A, and which has in it a groove, in which the ring (represented by the white line,) is loosely

placed, allowing the yarn to revolve around its surface. The opening of the plate is also seen. The shaft of the bobbin, E, is seen split for the purpose of spreading and tightening it.

The yarn is shown as it comes down from the rollers of a common spinning frame.

The detached figure, H, represents a ground view of the circular plate, and of the ring resting and playing upon J.

Description of an Improvement in Spinning, denominated the "Cap Spinner," being an improvement on the Ring Groove Spinner. Patented by JOHN THORP, *of Providence, Rhode Island, January 21st,* 1829.

THE circular plate described in the ring groove spinner, is in this improvement made deep, say about an inch, so as to form a tube, and is placed and confined like the plate in the former. There is in this apparatus, a part called the cap, which answers the purpose of a ring, in the ring groove spinner. This cap rests upon a rim which projects inwards about an eighth of an inch, on the lower edge of the tube; this cap is made in the form of a liquor tunnel, with its nose upwards; it encompasses the bobbin, which may be a common weaver's, or shuttle, bobbin, split in the manner and for the purpose described in the ring groove spinner. The lower edge of the cap, which acts on the yarn, is perfectly smooth and polished. When the bobbin is a common spinning, or throstle, bobbin, the cap is of one diameter throughout, forming a straight tube of the length of the bobbin, with a head at the top; which head is pierced through its centre, which steadies it on the spindle, or the tube may be considerably less in length, open at both ends, so as to allow the bobbin to pass up and down through it.

A thin, round, flat piece of metal, larger in diameter than the largest diameter of the cap, with a tube long enough to steady it, is placed horizontally on the top of the bobbin, or spindle, so that it can be removed and replaced with ease. Small polished notches on the edge of this plate, assist the yarn in revolving round the cap.

The plates and caps may be made of any suitable metal, and may be about one-sixteenth of an inch in thickness.

Fig. 5th, plate 1, represents the cap spinner.

A, A, A, are pieces of common step-rail, spindle-rail, and vibrating-rail.

B, a spindle of the common kind, excepting that it has no flyer.

C, the whorl, confined to the spindle.

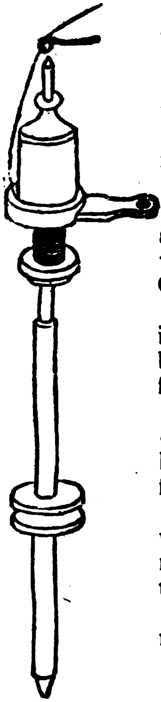
D, a box, being the upper bearing of the spindle, and in which it turns.

E, a common weaver's or shuttle bobbin, crowded on the spindle.

F, the thin, tubular, circular plate.

G, arms belonging to, and extending back from, the plate.

H, an arm, or stud, extending upwards from the vibrating rail.



I, A pin, or pivot, passing through the arms G, and stud H, forming a joint.

K, the conical socket, called the cap.

L, the thin, flat, notched, circular plate, fixed on the spindle.

The yarn is represented as it comes down from the rollers of a common throstle, or spinning frame.

The plate F, is about one-eighth of an inch thick, about an inch deep, and about one and three-eighths of an inch in diameter within. It is connected to the vibrating rail by a joint, as represented in the plate at G, H; the pin I, forming the pivot.

To find the end of the yarn when broken, the plate is lifted up, and the end of the yarn taken from the bobbin below the plate, and the plate being open in front, the yarn is then passed through it to the cap; or the cap may be lifted for the purpose of mending, or piecing the yarn, in which case the plate may be bolted to the vibrating rail, and need not be open in front, as represented in the drawing.

The wood cut in the margin, represents the cap when constructed in the manner best suited for spinning on a common throstle bobbin, or a bobbin with two heads.

In this the cap is taken off, for the purpose of mending, or piecing the yarn, as above described.

Specification of a Patent for an improvement on the "Can Spinner," consisting of a sheath or case to surround the cup or can. Granted to JOHN THORP, *Providence, Rhode Island, April* 3, 1829.

THIS improvement consists of a *sheath* or *case*, to surround the *cup* or *can*, and is intended to prevent the yarns from interfering, as they revolve round their respective cases, confining the yarn within a smaller space than it would otherwise require; also, to produce a friction on the yarn, so that it will wind tighter on the bobbin than it otherwise would do. This friction is occasioned by the centrifugal force of the yarn, pressed against and being dragged around the inner surface of the case. To increase said friction, a lining of velvet, or wash leather, or cloth, or any other suitable substance, should be cemented to the inner surface of said case, with paint, varnish, or any other suitable cement. The case is open at each end, and its length may be nearly the whole length of the can: it is made of tin, sheet iron, brass, or any other suitable substance, and may be formed into its proper shape, by bending it round the can which is to accompany it; and should be as much larger than the can, as will leave

a space between the outer surface of the can, and inner surface of the case, large enough for the yarn to revolve in. The two straight and perpendicular edges of the case, should lap by each other about three-eighths, or a quarter of an inch, leaving a space between the two lapped edges, sufficiently large for the yarn to pass through from the outside of the case, to the can; which will save the trouble of taking the case off from the spindle in mending or piercing the yarn, when the broken end remains below the can, as is represented in the drawing which accompanies this specification, and which is intended to illustrate the same. The cases have on the backside of them a projecting lip, or piece, which is soldered, or otherwise attached to them, by which they are confined to a rail or bar, that extends along the common frame, back of said cases.

I not only claim the exclusive right of using the above described case in my Can spinning, but in all kinds of spinning, where it may be useful.

JOHN THORP.

Reference to Fig. 6, *Plate* 1.

A, The can with a knob, or ball, at the top, by which it is held in lifting the can from the spindle.

B, the whorl which is connected with the bobbin, which bobbin is within the can.

C, the spindle, on the top of which the can rests.

D, D, The sheath, or case, surrounding the can.

The patentee states that he has found all the various plans which he has tried, to spin without the use of a flyer, to answer the purpose anticipated, but that there is, of course, a choice between them; he has, therefore, in practice, adopted two of them; one for spinning warp and filling, and another for hard twisted yarn for thread, twine, &c.

We shall publish in the next number, some other improvements in the manufacture of cotton, by the same gentleman, the engravings for which are now in preparation.

Specification of a patent for the discovery of a Water Proof Cement, or Hydraulic Lime. Granted to ROBERT LECKIE, *Washington, District of Columbia, March* 31, 1829.

THE mineral from which the above cement is made, is an argillaceous, ferruginous lime-stone, found in large compact masses, near Shepardstown, Jefferson county, Virginia. It is associated with good lime-stone, and may be called poor, or meager lime-stone. Its colour is of a grayish blue. It effervesces slightly with acids; when calcined, it is of a yellow, or cream colour, but is not always the same, some parts being of a light, and some of a darker yellow. It

is found in large bodies, has a flinty, or conchoidal fracture, but is not slatey, like the lime found in Pennsylvania.

The specific gravity is 2,7653.

It contains Carbonic acid,
Lime,
Water,
Silex,
Alumina,
Magnesia,
Oxide of Iron.

Preparation of the cement.—The stone is first calcined 40, or 48 hours, then ground to a powder, and mixed with clean sand in various proportions, from one-third to one-half; adding as much water as will make it into a proper consistency for use.

What I claim as my discovery, and for which I ask a patent, is that particular stone here described, and to be used as an hydraulic cement, and which I denominate hydraulic lime.

ROBERT LECKIE.

Remarks by the Editor.—In the second volume of the first series of this Journal, p. 288, a communication was published upon the subject of Mr. Guilford's discovery of hydraulic lime, on the Union Canal of Pennsylvania; upon this communication we made some remarks, which we now quote.

"Our correspondent P., informs us that a patent has been taken out by Mr. Guilford, for the hydraulic lime. We are at a loss to know for what discovery or improvement in the nature of the materials, or in the mode of using them, the exclusive right is claimed; so far as appears in the paper before us, there is nothing new in either; and, excepting there is something special, which is at present out of sight, we cannot conceive how a claim to an exclusive privilege could, in the present instance, be sustained, any more than it could for common mortar, made from a newly discovered bed of lime-stone. We do not pretend to much knowledge in the law, but apprehend that the 'discovery' contemplated in the patent law, is not the discovery of minerals deposited by the hand of nature, in the bowels of the earth."

"These remarks are made with deference, as the respectability and intelligence of the persons concerned, are such as to induce us to suppose that we may have fallen into the common error of judging without a sufficient knowledge of the premises."

Specification of a patent for manufacturing Paper from a material not heretofore used for that purpose. Granted to ELISHA HAYDEN COLLIER, *of London, but late of Plymouth county, Massachusetts, April* 15, 1828.

THE following is the description of my mode of manufacturing paper from a marine production, or sea-grass, designated by botanists, as "Ulva Marina."

First, all rock, roots, and shells, to be carefully separated from it.

Secondly, the dust to be cleared from it, by beating it.

Thirdly, to be steeped in lime-water, in order to discharge the salt from it, and thus prevent decomposition.

Fourthly, to be partially pulverized. (It can be bleached perfectly white by the use of oxymuriate of lime, otherwise called chalonic acid) [chloride of lime.]

Fifthly, to be made into pulp in the usual manner, either by beating, or in a paper engine.

Sixthly, to be dipped, pressed, sized, and dried in the usual way.

As the sea-grass, or ulva marina, is capable of being manufactured into paper by other modes than that above described, I claim as my invention, the manufacture of paper from the said sea-grass, or ulva marina, not by any particular mode, but by any process whatever which it may undergo; and whether such paper is composed entirely of the said sea-grass, or ulva marina, or mixed in any proportion with other materials heretofore known, or used for the manufacture of paper. E. H. COLLIER.

Specification of a patent for an improvement in the Copper-plate Printing Press, by which printing is executed with greater facility than on the ordinary press. Granted to CYRUS DURAND, *New York, May* 22, 1828.

BE it known that I, the said Cyrus Durand, have invented a new and useful improvement in the art of copper-plate printing, by an improved press, intended particularly for copper-plate printing; which invention, and the manner of using it, are as follows. This improvement consists, in the first place, of a bench, or table, perfectly level on the top, made either of wood or metal, upon which is placed a number of rollers, viz. 2, 4, 6, or more. These rollers being fixed in their proper situations by means of an iron frame surrounding them, on these rollers is placed the plank, or bed, of the common press, on which the plate is laid for printing; over which the large roller is to pass. This improvement, therefore, consists in the movement of the plank upon the small rollers; these moving at the same time with the frame surrounding them on the surface of the bench, or table, by means of which the friction attending ordinary presses is almost entirely removed; the labour not so great, and the impression more perfect. The cross, or levers, for turning the press, screws, &c. are similar to those that are used in the common presses. CYRUS DURAND.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

AUGUST, 1829.

Observations on Ignis Fatuus. By the Rev. John Mitchell.

Those luminous appearances, which are popularly called "Will-o'the-wisp" and "Jack-a-lantern," have been alike the object of vulgar superstition and philosophical curiosity; and notwithstanding all attempts to apprehend and subject them to examination, they are not much more the subjects of knowledge now, than they were centuries ago. They are still but an ignis fatuus to the philosopher, and a thing of mystery to the credulous.

I was myself, formerly, familiar with these appearances; they were of frequent occurrence near my father's residence, owing, probably, to the proximity of extensive wet grounds, over which they are usually seen. The house stood upon a ridge, which sloped down on three sides to the beautiful meadows which form the margin of the Connecticut, and of its tributary creeks, and which, owing to their own luxuriance and the deposits of the vernal freshets, are covered with rich and constantly decaying vegetable matter. From the circumstance, also, that we had no neighbours in the direction of these grounds, a light could not be seen over them without attracting our notice. I mention this by way of suggesting, that probably the ignis fatuus, in consequence of its not being always distinguished from the lights of surrounding houses, and therefore exciting no curiosity, is oftener seen than it is supposed to be.

These mysterious luminaries used often to be seen by the fishermen, who plied their nets by night as well as by day. They commonly reported that they saw them a little above the surface of the meadow, dancing up and down, or gliding quietly along in a horizontal line. Sometimes two, or even three, would be seen together,

skipping and dancing, or sailing away in concert, as if rejoicing in their mutual companionship. I might entertain you with abundance of fabulous accounts of them—the offspring of imaginations tinctured with superstition, and of minds credulous from a natural love of the marvellous. Fables, however, are of little value for the purposes of science: if the following account of some of the phenomena of the ignis fatuus, shall, with the observations of others, contribute towards a true theory of its nature, you will think them worthy of a place in your Journal.

A friend of mine, returning from abroad late in the evening, had to cross a strip of marsh. As he approached the causeway, he noticed a light towards the opposite end, which he supposed to be a lantern in the hand of some person whom he was about to meet. It proved, however, to be a solitary flame, a few inches above the marsh, at the distance of a few feet from the edge of the causeway. He stopped some time to look at it; and was strongly tempted, notwithstanding the miriness of the place, to get nearer to it, for the purpose of closer examination. It was evidently a vapour, [phosphuretted hydrogen?] issuing from the mud, and becoming ignited, or at least luminous, in contact with the air. It exhibited a flickering appearance, like that of a candle expiring in its socket; alternately burning with a large flame, and then sinking to a small taper; and, occasionally, for a moment, becoming quite extinct. It constantly appeared over the same spot.

With the phenomena exhibited in this instance, I have been accustomed to compare those exhibited in other instances, whether observed by myself or others; and, generally, making due allowance for the illusion of the senses and the credulity of the imagination in a dark and misty night, (for it is on such nights that they usually appear,) I have found these phenomena sufficient for the explanation of all the fantastic tricks which are reported of these phantoms.

They are supposed to be endowed with a locomotive power. They appear to recede from the spectator, or to advance towards him. But this may be explained without locomotion—by their variation in respect to quantity of flame. As the light dwindles away, it will seem to move from you, and with a velocity proportioned to the rapidity of its diminution. Again as it grows larger, it will appear to approach you. If it expires, by several flickerings or flashes, it will seem to skip from you, and when it re-appears, you will easily imagine that it has assumed a new position. This reasoning accounts for their apparent motion, either to or from the spectator; and I never could ascertain that they moved in any other direction, that is, in a line oblique, or perpendicular to that in which they first appeared. In one instance, indeed, I thought this was the fact, and what struck me as more singular, the light appeared to move, with great rapidity, directly against a very strong wind. But after looking some time, I reflected that I had not changed the direction of my eye at all, whereas, if the apparent motion had been real, I ought to have turned half round. The deception was occasioned by the

motion of the wind itself—as a stake standing in a rapid stream will appear to move against the current.

It is a common notion that the ignis fatuus cannot be approached, but will move off as rapidly as you advance. This characteristic is mentioned in the Edinburgh Encyclopœdia. It is doubtless a mistake. Persons attempting to approach them, have been deceived, perhaps, as to their distance, and finding them farther off than they imagined, have proceeded a little way, and given over, under the impression that pursuit was vain. An acquaintance of mine, a plain man, told me he actually stole up close to one, and caught it in his hat, as he thought;—"and what was it?" I asked. "It was'nt nothin."* On looking into his hat for the "shining jelly," it had wholly disappeared. His motions had dissipated the vapour, or, perhaps, his foot had closed the orifice from which it issued. To this instance another may be added. A young man and woman, walking home from an evening visit, approached a light which they took for a lantern carried by some neighbour, but which, on actually passing it, they found to be borne by no visible being; and taking themselves to flight, burst into the nearest house, with such precipitation as to overturn the furniture, and impart no small share of their fright to the family.

The circumstance that these lights usually appear over marshy grounds, explains another popular notion respecting them; namely, that they possess the power of beguiling persons into swamps and fens. To this superstition Parnell alludes, in his Fairy Tale, in which he makes Will-o'the-wisp one of his dancing fairies;

"Then Will who bears the wispy fire,
To trail the swains among the mire," &c.

In a misty night, they are easily mistaken for the light of a neighbouring house, and the deceived traveller, directing his course towards it, meets with fences, ditches, and other obstacles, and by perseverance, lands at length, quite bewildered, in the swamp itself. By this time, he perceives that the false lamp is only a mischievous jack-a-lantern. An adventure of this kind I remember to have occurred in my own neighbourhood. A man left his neighbour's house late in the evening, and at daylight had not reached his own, a quarter of a mile distant; at which his family being concerned, a number of persons went out to search for him. We found him near the swamp, with soiled clothes and a thoughtful countenance, reclining by a fence. The account he gave was, that he had been led into a swamp by a jack-a-lantern. His story was no doubt true, and yet had little of the marvellous in it. The night being dark, and the man's senses a little disordered withal, by a glass too much of his neighbour's cherry, on approaching his house, he saw a light, and not suspecting that it was not upon his own mantel, made towards it. A bush, or a bog, might have led to the same place, if he had happened to take it for his chimney top. [*Silliman's Journal.*

* In the colloquial double negative of the common people of New England. Ed.

***On the penetration of Water into Stoppered and Corked Bottles, sunk to a great depth into the sea.* By J. de C. Sowerby, Esq. F. L. S., &c.**

[From the Philosophical Magazine, for August, 1828.]

Many papers having at different times appeared upon the popular paradox, a bottle filling with water when sunk to a great depth in the sea, however well it may have been corked and sealed, without any satisfactory explanation having been given, and seeing the subject resumed by Dr. Green, in your Philosophical Magazine for this month, I am induced to send you my explanation of the phenomenon.

Dr. Green thinks that by proving (as others had done) that the water would not penetrate glass, he had reduced the question into very narrow limits; and that the water enters glass vessels through the "cork and all its coverings, in consequence of the vast pressure of superincumbent water, in the same manner as blocks of wood are penetrated by mercury in the pneumatic experiment of the mercurial shower."

It may be concluded from recorded experiments, that well fitted glass stoppers (by the by, every chemist knows such are rarely to be obtained as will confine the vapour of nitric acid) will exclude the water; corks, when properly protected, will also prevent the water from entering. When mercury is made to pass through a block of wood by pneumatic pressure, it finds its way by the longitudinal tubes; such tubes do not exist in cork. My explanation is this; cork is elastic, and by the pressure of the sea is readily condensed, and consequently much diminished in bulk, first that part out of the bottle where the sides are not protected by the neck, and then gradually the remaining length, until the cork, separated entirely from the glass, affords a free passage for the water, unless the sealing, or wrapper, be of such a tenacious and ductile nature as to adhere to the glass and the cork so as to fill up the space that would otherwise be left, and yet not yield completely to the pressure; if it be brittle, it either separates from the glass, or cracks, or both, allowing a free passage to the water. Even pitch, when cooled in the deep water, would be very brittle, and crack, or separate from the bottle readily, and it would resume its former ductility and appearance upon returning through the warm surface: this and similar considerations will show how a trifling difference in closing the bottles may produce considerable differences in the results of the experiments. I remain, yours truly.

J. de C. Sowerby.

***Reply to* Mr. J. de C. Sowerby's *remarks on "Experiments on the Pressure of the Sea at considerable Depths."* By Jacob Green, M. D. Professor of Chemistry in Jefferson Medical College, Philadelphia.**

[From the Philosophical Magazine.]

In your valuable Magazine for July, 1828, there appeared some remarks made by me, "On the Pressure of the Sea at consider-

able depths;" and in the next number, J. de C. Sowerby, Esq. has favoured us with a kind of criticism on the communication. Now, although the subject is not a very important one, still no person feels satisfied with having his statements misrepresented, whether this be done through mere inadvertence, or in any other manner; I hope, therefore, you will allow me a word in reply.

The conclusion that I drew from my experiments, was, "that at the depth of 230 fathoms, the water enters glass vessels through the stoppers and coverings which surround them, and not through the pores of the glass:"—not that the fact, that water will not penetrate glass at all, as Mr. S. says, has been so often proved before, but merely that it will not at the depth of 230 fathoms. Now, if Mr. Sowerby had shown us that this fact had ever been proved before, his remarks would have been in point, and I should have thought my experiments of no value. The fact, however, never could have been proved without using a glass vessel *hermetically* sealed; and which, as far as my knowledge extends, never was done before. Mr. S. says, "Dr. Green thinks that by proving (*as others have done*) that the water would not penetrate glass, he has reduced the question to very narrow limits." Mr. S. should certainly have given us his authorities here; and until they are produced, I shall consider my experiment as the first to settle the fact.*

The misrepresentation to which I have alluded, is, that Mr. S. cites me as concluding that the water enters glass vessels through the "cork and all its coverings, in consequence of the vast pressure of superincumbent water, in the same manner as blocks of wood are penetrated by mercury in the pneumatic experiment of the mercurial shower." If any one will take the trouble to turn to the passage in your July number, p. 37, he will see that I have given this as the opinion of other experimentalists, whose names and works are referred to at the bottom of the page. A considerable part of Mr. S.'s short communication, is, to show that water will not pass through a *cork* in the same manner as mercury through a block of *wood*,—an opinion which I never maintained. I can, however, inform Mr. S., that mercury in the pneumatic experiment of the mercurial shower, will penetrate cork much in the same way as it does blocks of wood; and though not by *longitudinal tubes*, yet in a manner sufficiently analogous to justify the comparison made by the gentleman I have quoted.

Mr. S. concludes, "from recorded experiments, that well fitted glass stoppers will exclude the water." Now, for the same reason, I conclude that they will not: and as I have some authority for the fact, besides my own experiment, which, by the way, Mr. S. will not place among the *recorded*, he must produce further evidence.

* In the Rev. Mr. Campbell's account of his second Missionary Journey in South Africa, published about seven years ago, at the end of the second volume, Dr. Green will find the particulars of an experiment made by Mr. Campbell with two globular bottles hermetically sealed. They were sunk to the perpendicular depth of 200 fathoms, and on being raised, they were found *empty*; thus proving, that, at this depth at least, water will not penetrate glass.—ED.

For myself, I am by no means satisfied with Mr. S.'s explanation of the phenomenon alluded to. How that part of the cork which is protected by the neck of the bottle from the *lateral* pressure of the sea, should be diminished in its bulk, or diameter, by the perpendicular or superincumbent pressure, so as to be separated from the glass all round, is what I cannot understand. So far from getting the cork through the neck of the bottle, by Mr. S.'s mode of explanation, it seems to me that we shall only wedge it in the tighter.

There is one part of the explanation proposed by Mr. S., which struck me as a new fact. It is as follows: "even pitch, when cooled in the deep water, would be very brittle, and crack, or separate, from the bottle readily; and it would assume its former ductility and appearance upon returning through the warmer surface" (*warmer medium?*) Now, before this, I supposed that common pitch melted at about 150° Fahrenheit, and that the temperature of the ocean at a considerable depth, was much colder than at the surface. Even at the equator, the surface of the water is generally 80° Fahr., and it diminishes as the latitude increases. At a distance from land, where our experiments must be made, it also diminishes as the *depth* increases. In a *recorded* and authentic experiment, it was found that when the surface of the water was 40°, at the depth of fifty fathoms the thermometer stood at 25°.*

I could say more, but I fear I have already taken up too much of your space with this subject.

Yours, truly,

JACOB GREEN.

On the Cloth and Paper made from Amianthus, a Species of Asbestos.

[From the Virginia Literary Museum.]

AMIANTHUS, a variety of Asbestos, contains, per cent., about 59 parts of sand, (*silex*,) 25 of magnesia, and 10 of lime, besides traces of clay and iron oxide.—It is usually found in veins, and consists of fibres very flexible, and somewhat elastic. Friction readily separates them, and when dressed a little, they bear a considerable resemblance to fibres of silk or flax.

* We are at all times happy to insert the replies of writers whose papers may have been the subjects of animadversion in our pages; but we think that some passages of Dr. Green's reply to Mr. Sowerby, as above, require a few remarks from us. Mr. Campbell's anticipation of Dr. Green's experiment with a glass vessel hermetically sealed, has been noticed in the preceding page; and Dr. G.'s observations on the cooling of the pitch by the diminished temperature of the deep water, tend, as it appears to us, to confirm Mr. Sowerby's opinion. The appearance and ductility of pitch at temperatures of moderate warmth only, are alluded to by Mr. Sowerby, whose remark has no reference to its liquefaction; and the fact that the ocean at a considerable depth is much colder than at the surface, is the very ground of that gentleman's statement on this part of the subject. Some experiments with wine bottles secured with pitch, &c., made by Mr. Campbell at the same time he sunk the globular bottles already mentioned, also appear to confirm Mr. Sowerby's observations.—ED. PHIL. MAG.

This filamentous nature, and the power of enduring a red heat, without any very apparent loss of substance, have long rendered amianthus celebrated among minerals. All its names are in allusion to these properties, or their applications to useful purposes.

Asbestos, for example, the original term, comes from the adjective ἀσβεστος, *inextinguishable*, from a supposed practice among the Greeks, of using the mineral to form wicks for their perpetual or sepulchral lamps.

Amianthus, also, bears, in its etymology, an indirect allusion to the effects of fire. The word ἀμιαντος, which signifies "incapable of being soiled," was given in consequence of the facility with which articles, manufactured from this mineral, were cleansed by means of fire.

Other names were bestowed upon it, which may be briefly noticed —the Romans called it *Linum Vivum*, both from its resemblance to flax and its indestructibility. It was also named *Linum Indum*, *L. Montanum*, *L. incombustibile*, *Lana Montana*, *Salamandra lapidea*, &c. The last name seems to have arisen from a conjecture that the fable of the salamander originated from a practice among the ancients, of purifying by heat, the various fabrications of this mineral.

Asbestos and amianthus, are the terms which have passed into the principal European languages.

We have the most positive records, that this substance was in use among the Greeks and Romans, for the purpose of manufacturing articles in imitation of linen. The workmanship and quality, if we credit the testimony of Pliny and Plutarch, must have been of a very superior character.

The former writer ranks the amianth cloth, next in quality to the Byssus, or fine cotton, worn by wealthy ladies. Plutarch also states, that this mineral was wrought into head ornaments for females. It does not appear, however, that the art of weaving it was sufficiently general to render the cloth cheap. Indeed, every circumstance seems to show, that this fabric must have been an article of luxury among the ancients; and there certainly was an obvious, though, perhaps, excusable parade of its incombustible properties, upon all occasions. The practice in Pliny's time, and which he describes as an eye-witness, was, to toss the napkins of amianth into the fire, after a repast or banquet, in order that the grease and dirt might be burnt out. Each guest thus delighted in becoming his own washer. The same vain and clumsy display, we may observe, is recorded of the first dauphin, Charles V., during whose reign, amianthus manufactures seem to have been established at Venice, Louvain, and other parts of Europe. Pliny notices another very important use of mineral cloth, namely, as a shroud, or wrapper, for the bodies of kings, in order to preserve their ashes distinct from those of the funeral pile. That such a practice existed, we have positive proof, independently of the historian's testimony, by the discovery, in 1702, near the Porta Næva at Rome, of a funeral urn, ornamented with elegant *basso relievos*, and containing a scull with some calcined bones—a quantity of ashes was also found enclosed within a cloth

of amianthus, nine Roman palms long and seven wide. This relic was deposited in the Vatican library, by order of pope Clement XI. The very diminutive size agrees but badly with Pliny's account of its use, and will serve to caution us against confidence in his other exaggerated statements. It is said, that the disuse of burning the dead occasioned the decline of the manufacture of these cloths, until the art became entirely extinct in Europe. The correctness of this opinion will be noticed presently. Thread, nets, net-work, head ornaments, napkins, table and funeral cloths, seem to have constituted nearly all the articles manufactured of amianthus in former times. Bonnets, gloves, purses, girdles, ribands, and even paper, have been subsequently made from it. The process by which the mineral fibre was anciently woven, is not transmitted to us. In 1691, Ciampini of Rome, published the following plan in his work, "de incombustibili lino," and it may be considered nearly as precise as the nature of such manufacture will permit. Having steeped the amianthus in warm water, divide its fibres, by gently rubbing them together between the fingers, so as to loosen and separate all the extraneous matter; then pour on, repeatedly, very hot water, as long as it continues to be in the least discoloured. After this, nothing will be left but the long fibres, which are to be carefully dried in the sun. The bundles are then to be carded by very fine instruments, and the long filaments, thus obtained, steeped in oil to render them more flexible. A small quantity of cotton-wool, or flax, is next to be mixed (taking care that the mineral fibre is in every part, the principal material, and smoothly adjusted;) by means of a spinning wheel, the whole is to be drawn into a thread. The cloth being woven, in the usual manner, is placed upon a clear charcoal fire, and made red hot, so as to burn out the vegetable, or animal matter, &c. The remaining tissue will consist of pure white amianth. This kind of cloth has also been made, without the assistance of other substances, by rubbing and soaking the mineral fibres, until they become so delicate and soft as to admit of being spun at once into threads. This is the process recommended by Madam Perpeuti.

The very short fibres which separate, during the repeated washings, may be subsequently worked into paper. For this purpose, however, they require to be well beaten, until reduced to an impalpable powder, and, subsequently, to be worked up with a large quantity of size in water. These precautions are far more necessary for the amianth than for cotton or linen paper, in consequence of the much greater weight of the mineral paste. After the paper has been formed, the sizing is burnt out.

We will now briefly trace the decline of the mineral weaving, &c. It is apt to be the most glaring characteristic of the antiquarian virtuoso, to lament the loss of certain arts among the moderns, nor does *utility* always constitute an item of his regrets. The ancient process for weaving amianth cloth, appeared to be extolled, not from any accurate knowledge of the fact, but because an obscure hint or two about its superior quality, may be found among a few writers of antiquity. One of these authorities (Pliny,) it is true, compares it

with the byssine cloth, obtained from the neighbourhood of Elis, and which was very much esteemed; but, while he thus intimates its superiority, he elsewhere bears indirect testimony that the cloth was used merely as a rare and curious article. This writer furnishes three strong reasons why amianth cloth could not have been in common use among the Romans. The first is, the difficulty of procuring the mineral. It is described as occurring on the deserts and parched grounds of India, where rain never falls, and where serpents and other formidable reptiles abound. *Secondly*, it is stated that the amianthus, when obtained, was very scarce, and commanded a price equal to that of the most costly pearls. *Lastly*, it is expressly noticed that the workmanship was exceedingly difficult, on account of the shortness of the fibre. These statements are not only in opposition to the belief that the ancients used such articles generally, but the last one goes far to contradict the assertion of Pliny himself, respecting the quality. We have, however, a still stronger fact to show, that even in the rich and luxurious times of the Roman empire, the mineral cloth was not in much use for the purpose of collecting the ashes of the dead. Out of the immense number of ancient sepulchres opened in Italy, during modern times, not more than one such cloth has ever been discovered, and that (found at Rome, 1702,) is of very coarse texture, and too small to answer the purpose of a wrapper for the body. In several urns charcoal was found mixed with the ashes, a circumstance indicating no great care.

The truth is, that the cloth has always ranked as a curiosity, and, not unfrequently, has had bestowed upon it properties calculated for the credulous and ignorant. Pliny, who was ever too partial to hearsay records, has condescended to state, upon the authority of one Anaxilaus, that amianth cloth, merely wrapped round a tree, has the power of depriving the blow of a hatchet of all sound. The same relish for the marvellous, no doubt, induced Marco Polo to state, that the body of our Saviour was, in his time, preserved at Rome in a shroud of amianth, or incorruptible cloth. Athanasius Kircher, (a jesuit of the 17th century,) in his "*Mundus Subterraneus*," also extols the mineral with all the zeal of a connoisseur. He boasts of having, in his collection, paper, a screen, and a lady's veil of it, together with a lamp-wick, which had burnt for two years without consuming, and which, he wisely adds, will last for ever, if not stolen. Whether this wick is still in operation, we have not learnt, but may venture to conclude, notwithstanding the testimony of partial advocates, that the decline of the art afterwards among the moderns, is wholly owing to the insignificance of the articles manufactured.

Experiment has abundantly proved, that although the amianth fibres are alone able to resist a red heat without much change, they soon, (even in twenty-four hours) become incapable of transmitting a full supply of oil, owing to an imperfect cohesion effected by the flame. Hence it is impracticable to convert them into perpetual lamp-wicks. Neither is it true that a red heat has *no effect* upon them. Cloth, woven of amianth, actually does lose weight by burn-

ing, and, after repeating the operation several times, the fibres become so brittle as to render it difficult to prevent them from crumbling to pieces. In two experiments, made before the Royal Society of London, a cloth, one foot long by six inches wide, and weighing nearly $1\frac{1}{2}$ ounce, was found to lose, by the application of a red heat, more than one-twelfth of its weight each time. It would be considered a very bad piece of common linen that could be worn out in twelve washings!—The only advantage which such cloth seems to possess over the ordinary kind, is, the facility of cleansing it by fire; but, really, soap is so cheap an article, that there could not be much gained in this respect, by a change of fabrics. The amianth paper has even less to recommend it. It would be curious, no doubt, to return an answer upon the same piece of paper as that which was received from the post office, merely by *burning out* the original; but it could not be agreeable to find our ink spreading at every letter, an inch wide, upon paper from which the fire had removed all sizing. So, also, it might appear highly important to possess an *incombustible* paper, upon which could be spread all important documents; but, (not to mention the thousand methods of getting rid of the troublesome records without burning them) we must bear in mind, that an *unalterable* ink is as important as the paper, and none of those proposed has been found to be sufficient. *Incombustibility* alone, must compensate for the article being heavy, coarse, weak, liable to blot, and not capable of taking the full impress of types. Books, it is true, *have* been printed upon this kind of paper, among which may be noticed the work preserved in the library of the Royal Institute of France; but, however highly authors may esteem their own productions, we feel fully persuaded that booksellers would not tolerate such nonsense from them now-a-days. To conclude, it may be observed, that, while it is not, by any means, our wish to interfere with the virtuoso's taste for neck-handkerchiefs and shirts of *stone cloth*, we must take the liberty of hinting, that, if the perfect art of weaving it *does not* now exist, there is not much lost. P.

On the Manufacture of Red and Flame Coloured Glass. By M. Engelhardt.

The ancients employed the oxide of copper for colouring glass red; but the colour which this oxide gives to the glass, is so intense, that glass of an ordinary thickness would be of a brownish-black colour, and but little diaphanous. It then becomes necessary, that in order to obtain a red colour, we must find out a process, by which this dark colour may be diffused, or thinly spread, over the glass without inconvenience. This may be effected by covering white glass with an exceedingly thin layer of the red glass; and by this contrivance we can unite the double advantage of having a fine colour, and a transparency also.

According to Kunckel, the oxide of gold is employed as the colouring principle in the colouring of red glass. And in fact the

oxide of gold does produce a fine red, with which glass may be coloured in fusion, without prejudice to its transparency; and consequently it may be advantageously employed in the making of vessels and other similar objects. But its employ must always be greatly circumscribed, on account of the high price of this colour, and other difficulties. Thus, for instance, we cannot always obtain from the oxide of gold, the fine purple or flame coloured glasses seen in the ancient windows of our churches; the glasses thus coloured have always a crimson, or rose tint, and may be distinguished at the first glance of the eye. The property which the oxide possesses of colouring glass red, may be readily proved with a mixture of the glass of borax, and the oxide of copper, and treating them with the reducing fire under the blow-pipe. For, in order that the copper shall produce a red colour, it is essentially necessary that it be treated in the reducing flame. And it is for this reason, that with the bellows we cannot apply it in the state of enamel, as with the other colours employed in tinging glass; because the red glass becomes changed to a bluish-green colour, by the fusion and the calcination of the copper in it.

Thus the ancients were obliged to use crude tartar, or lamp-black, or other de-oxidating bodies, when they would preserve their glass of a red colour. They also sometimes used the oxide of iron when they wished to obtain a red flame colour partaking of yellow; but the agent which produced the best result in this respect, was the oxide of tin. The effect of the oxide of tin was more certain and fixed than vegetable substances; but it also possessed the inconvenience of colouring the glass brown if the combustion was not perfect. During the whole time of working with the oxide of tin, they constantly kept the furnace at a uniform red heat; but this was not necessarily the case when they added the other de-oxidating substances. I have always found the oxide of tin in all the ancient glasses which I have analyzed; and not only this oxide, but generally, also, a much larger quantity of the oxide of copper.

As the colour obtained from the oxide of copper is too intense to be worked alone, the coloured glass being in some parts opaque, and in others appearing of a brown shade, and as it must be blown too thin for use, in order to obtain it of a transparent red colour, so they can only procure red and diaphanous glasses, by coating white glass with a very thin layer of the red glass. In this way they prepare a glass, which is termed *double glass*; and which has likewise the advantage of permitting us to remove the red coat, when we would either obtain white designs or drawings, or designs enamelled with other colours. We shall now state the process of the ancients, as we find used in all those glasses of the middle ages.

To manufacture this glass in layers, the workman employs two pots, or crucibles, the one containing the red glass, the other the white; he commences by plunging his iron *cane*, or blowing-tube, into the red glass, so as to bring out a lump of it, and then plunges it into the white glass. The cylinder blown out of this mixture, thus affords a glass of a fine red colour. In order that the red layer

should remain in perfect contact with the white glass, and should not detach itself in the cooling; it is necessary, that at the first forming, the union of the white glass with the red, be made completely perfect; it is also better that the mass of red glass should be heated hotter in the crucible than the white; and care must also be taken, that the component parts of the red glass should not be formed of any oxiginating substances. In order to commence working in the glass-house fire, I first put in the small crucible to contain the red glass, amongst the large pots. I then introduce into this first pot, in addition to the ordinary frit, or materials used to form glass, (provided that they contain no manganese,) two ounces of oxide of copper, and two ounces of oxide of tin, for every five pounds of the ordinary materials; but if it does not contain any such materials, I take for every two pounds of the sand contained in the frit, an ounce and a half of the oxide of copper, and an ounce of the oxide of tin. If I do not immediately add the oxide of copper, but introduce it afterwards, when the glass has become transparent, I then employ rather less of the oxide of copper.

To produce a scarlet layer, I take for every twenty-five pounds of the usual materials for making glass, half a pound of oxide of tin, and three-quarters of an ounce of the oxide of tin, made into an exceedingly fine powder; and these I add at the commencement of the operation.

When the mass has become transparent, I then put in three-quarters of an ounce of the oxide of copper, and mix the whole with great care. In general, I also take every possible pains to prevent the formation of any bubbles, or lumps in the glass, which are but too apt to take place; I likewise take care that both the masses of the white, and of the red glass, be brought to the same degree of fusion whilst they are being worked.

The perfectly forming of a fine glass, depends very much upon the skill of the workman, and he ought to make himself master of the details I have above given; observing also, that the outer layer of glass should be thinner at the mouth of the tube, than at the opposite side of the cylinder; or else the glass would necessarily be deeper coloured at that end than the other, and then the centre would not present an even tint; and indeed, if one of the ends should become too thin, the colour would entirely disappear, and be lost in the white glass. I possess many glasses, however, in which the transition from the dark to the light tints, is employed in producing certain effects with great advantage.

For the rest, the workman may soon acquire, by a little practice, the necessary dexterity to enable him to make uniform glasses, and of sufficiently large dimensions; and I hope to obtain this result in all our glass-houses, having made arrangements to that effect.

A mass, or frit, containing lead, appears to preserve the red colour better than any other; nevertheless, my experience in this respect, is not sufficient to enable me to pronounce decisively thereon. When the red colour of the glass in the furnace disappears at any time, owing to the oxidation of the copper, and the glass takes a

bottle-green colour, by adding a de-oxidating body to it, such as charcoal in powder, crude tartar, lamp-black, or other analogous substances, we can again produce the red colour. The crude tartar, or the charcoal, are preferable for this purpose, as they can be more readily obtained in a state of purity than the lamp-black. After adding these de-oxidating matters, we should not use the upper layer of glass in the crucible, which is too deeply coloured, and too impure; but the lower parts soon become very fine, and of a clear tinge. Nevertheless, as that red is always the most beautiful in which there has been no occasion to employ these matters, so we should endeavour to avoid the necessity of adding them as much as possible, and strive to keep the mass of red glass continually transparent in the furnace.

Remarks by the Editor of the Technological Repository.—We believe that this process of forming red glass by what is termed *flashing* white glass, has long been used in this country; and particularly by the late Mr. Honeybourne, of Brierly Hill, near Stourbridge, who was celebrated for his skill in making coloured glass. And we continually see the small red glass lamps, used in public illuminations, thus formed. The process may not, however, have been practised in modern times in Prussia; and this communication will, therefore, no doubt, prove highly useful there, as well as in other countries also. [*Tech. Rep.*

On the Materials which the Romans employed in their Buildings. By MR. C. T. RAMAGE, A. M. *of Naples.*

THE materials which were used in the erection of the various edifices, which add so much interest to the ancient city of Rome, may be ranged under two great classes. The first consists of the common materials for building, which were found in the immediate neighbourhood of the city, such as limestone, pozzolana, clay, and silex; the second, of those which were brought from a distance, white and coloured marbles, granites, and porphyries.

Their mortar was made, as it is at present, either from common limestone, or from a stone which Vitruvius calls silex, and which may, perhaps, correspond with our compact calcareous limestone. That which was obtained from the last, was employed in the construction of walls, while the other was used as plaster. This mortar was mixed either with *Arena fossica*, sand dug from pits, or *Arena fluviatica* and *marina*, from rivers and the sea. Of the first they had several sorts, black, white, and red, together with that to which we give the general name of *pozzolana*. The vicinity of Rome abounds with this last sort, and the inhabitants still use it for the same purpose. The place from which the sand was dug, was called *Arenarium*, and these excavations have, no doubt, given rise to the catacombs in Rome. The colour of this *pozzolana* is by no means uniform, for it is sometimes found red, sometimes purple, and some-

times the colour of tobacco. Its name is derived from *Pulvis puteolanus*, because it was originally found in great quantities in the neighbourhood of Pozzuoli, near Naples. It was particularly used for buildings under water, because it resisted the influence of that element, and acquired such a consistency as to form a solid mass of stone and brick. A proof of this is found in the ruins of the harbour of Antium, and of the mole of Pozzuoli, which is called the bridge of Caligula, though it must date its origin long before the reign of that emperor. It is curious to observe, that on the shore of Baiæ, where Horace accuses the Romans of attempting to deprive Neptune of part of his territory, the foundations of the houses in the sea still remain, while those on the shore have entirely disappeared, and left scarce a vestige behind them. On examining these foundations, it is found that they consist of this sort of cement, bricks, and sometimes pieces of tuffa. The sand from the sea and river was never employed when the other sort could be found, and the same observation may be made regarding gravel (glarea.) The cement, according to Vitruvius, was composed of three parts of pit sand and one of limestone, or, rather, of two parts of river, or sea sand, and one of lime. They generally added a third part of pounded shell, to correct the defects of the sand, and to render the cement more firm and tenacious.

Clay was employed in the formation of their bricks, and must have been in great request in Rome, as their buildings are chiefly composed of this material. We are told by Vitruvius, that, in his time, the bricks were dried by the rays of the sun, and he enters into a minute description of the method which they employed; in the ruins, however, existing at Rome, we observe only bricks baked by artificial fire. On an attentive examination of those found in Rome and Pompeii, we discover that the clay which they used was generally of two sorts, yellow and red, and that they mixed with it tuffa dust to render it more compact. Their size differs according to the use which was made of them, and the time they were formed. The bricks employed in courts are generally triangular; those which we call tiles, and which served to bind together the roof to the entire mass of the wall, are a foot and a half square; and those which were used for arches, are quadrilateral, and are a foot and a half long, and half a foot broad. All the ancient bricks are much finer in the grain, and are easily distinguished from those of the present day.

The stones which were employed in the buildings of ancient Rome, are the following: tuffa, which Vitruvius calls lapides rubri; peperino, or lapis albanus; travertino, or lapis tiburtinus; silex, and pumice-stone. The first four are found in the foundations and outer facings of the buildings, as well as in the internal construction of the walls and vaults; the silex was only employed in the pavement of the streets, and the interior masses of the wall; the pumice-stone was particularly used in vaults from its lightness. Tuffa is found in every part of the country round Rome; and the ancient quarries, alluded to by Strabo, may be seen near the Anio, at Cerveretta, five miles beyond the Porta Maggiore, to the left of the Via

Collatina. It is a volcanic production, of a colour more or less red, and of no great solidity, as it is easily decomposed by exposure to the atmosphere. The foundations of the buildings on the Palatine Hill, are of this stone, and the temple of Fortuna Virilis, and the aqueduct of Claudius, are also built of it. In this case, they either rough-cast the outer part of the wall, or cut it in sufficiently large pieces to resist the action of the air; the first method is observed in the above mentioned temple, and the other is found in the aqueduct of Claudius. Tuffa was employed also in Rome and its neighbourhood, for that sort of building, which, from its form, was called reticulated. This commenced on the decline of the republic, and ceased about the time of Caracalla. The vicinity of Naples abounds also with this stone, and, indeed, the city is almost entirely built of it. The grotto of Posillipo passes through a mountain of this sort, and the perforations in the neighbourhood of Cumæ, Baiæ, &c., which are supposed to have been the abodes of the Cummelii mentioned by Homer, are dug in the same volcanic matter.

Lapis albanus, Peperino, also a volcanic production, derived its name from Mount Albanus, and its quarries are seen at present in the neighbourhood of Marino; its greenish grayish colour, and the resemblance it bears to pounded pepper, has given rise to the vulgar name of Peperino. This stone, as well as that called *Lapis Gabinus*, resists the action of fire, and, on that account, Nero, according to Tacitus, issued a decree, after the burning of Rome, that all the houses should be built of one or other of these stones. The peperino is more solid than tuffa, and is less influenced by atmospheric changes, though it also suffers. The walls of Servius, at Rome, were built of it, as may be still observed under the temple of Victory, on the declivity of the Quirinal, where there are still some remains. It has also been employed in the erection of the enclosure of the forum of Nerva, the temple of Antoninus, and Faustina, &c. The *Lapis Gabinus* very much resembles peperino, and is found at Gabii, about twelve miles from Rome. Its colour is the same; but it is much harder and more porous; the ancients employed it more particularly for millstones.

Travertino, a name corrupted from Lapis Tiburtinus, was brought from the neighbourhood of *Tibur*, Tivoli; and even now you see the ancient excavations between the *Aquæ Albulæ* and *Pons Lucanus*, to the right of the road. It is a calcareous concretion, formed by sulphureous waters, and those of the Anio; it is extremely porous, resists the action of the atmosphere, and hardens in proportion as it is exposed; fire, however, decomposes and calcines it. The amphitheatre of Flavius, the sepulchre of Metella, and many other monuments on the Appian Way, are of this stone. Its colour is originally white, but, from long exposure, it acquires a yellowish hue, which adds much to the beauty of the buildings. The Romans cut it in large quadrilateral masses, and employed it without cement for their edifices. The temples and walls of Pæstum are of the same material, and the quarries where the cyclopic masses were excavated, are seen without the walls of the city. Some of the stones are twenty-four

feet in length. There is a bridge at Benavento, which is observed to be of the same structure and same material. *Silex* is a different stone from the one which is known to mineralogists under that name; it is a basaltic lava, of an iron colour, which, from its peculiar hardness, was employed in walls and the pavement of streets. The quarries are found on the Appian Way, beyond the sepulchre of Cecilia Metella, and in many other places in the vicinity of Rome. Pumice-stone,* from its extreme lightness, was reserved for the erection of vaults; and you find it employed in those of the Coloseum, and the magnificent cupola of the Pantheon. It was brought from the neighbourhood of Vesuvius.

These are all the common materials which the Romans employed; and before we proceed to notice those ornametal stones, which added so much beauty to their edifices, we shall attempt to mark the different epochs in Roman history, when these materials were used.

The most ancient Roman buildings are constructed of the lapis albanus, because Alba was the first important conquest which the Romans made; and it is natural to suppose that they would prefer the stone which could be most easily procured. This continued to be used, not only during the regal government, but almost to the fall of the republic. The Carcer Mamertinum, constructed by Ancus Marcius; Cloaca Maxima, the work of the Tarquins, parts of the wall of Servius, under the Quirinal; the sepulchre of the Scipios, and many other ancient monuments, are built of this stone. When Tibur was subdued, A. M. 417, they began to introduce Travertino, which was ever afterwards promiscuously used with the lapis albanus. As it is harder and more compact than peperino, it was particularly used for ornaments, arches, and architraves. Thus, the doric capitals and architrave of the tabularium, the insulated columns of the temple of Fortuna Virilis, and the arch of Dolabella on the Mons Cœlius, are composed of this stone. As far as we can perceive from the remains of antiquity, square masses of stone were used during the kings and the republic. But on its decline, they introduced that sort of construction which Vitruvius calls *Opus Incertum*, and which must not be confounded with that formed of large polygons, which we see at Cora, Præneste, and other ancient cities of Latium. Vitruvius, indeed, tells us, and we can perceive it from the ruins, that this *opus incertum* consisted of small stones mixed with mortar. There is an example of it in Rome, in the temple of Romulus, under the Palatine; at Tivoli, in the temple of Vesta; at Præneste, in the temple of Fortune, and in many other ruins scattered through the country. On the contrary, the walls of the above mentioned places are built of massive polygons of three, four, and five feet in length, and without mortar. The *opus incertum* is only an outward facing of the wall, and is supported behind by a mass of every sort of material.

The *opus incertum* was soon succeeded by the *opus reticulatum*,

* The pumice mentioned above, is, we presume, vesicular lava, not the pumice of geologists.—Ed.

which is mentioned by Vitruvius, as the fashionable architecture of his age, and which continued to be, more or less, used down to the reign of Caracalla. This reticulated construction derived its name from its resemblance to net-work, and was formed of stones found in the neighbourhood, which were cut into the form of coves. At Rome, the stone is tuffa; at Præneste, calcareous limestone; at Tivoli, travertino; and at Tusculum, a kind of peperino, which the Italians called *Piatra Tusculana*. As this particular sort of construction could not be used in the angles of houses, they seem generally to have introduced bricks, and sometimes stones of a rectangular shape. There are several beautiful specimens of this reticulated work at Rome; the gardens of Sallust, under the Quirinal, and the palace of Mæcenas, may be mentioned as worthy of inspection. In both these, you see this net-work promiscuously used with bricks, regarding which we shall now make a few observations.

The *Opus lateritium*, or brick-work, began to come into general use in the time of Augustus, and maintained its ground to the fall of the empire; it was nearly equal in strength to the massive stone-work which was originally employed. There were many changes during this long period, in regard to the form of the bricks, and the quantity of cement. In the reign of Augustus, they were generally made of a red earth, of a triangular form, and about an inch in thickness, as may be seen at the gardens of Sallust, at the palace of Mæcenas, under the Esquiline, and at the palace of Augustus on the Palatine. Under Tiberius, the earth was of a deeper red, or yellowish, as is proved by the prætorian camp without the Porta Pia; and in the time of Nero, they mixed the yellow and red bricks in their buildings, as the aqueduct near the Porta Maggiore shows. They are much smaller than those of Augustus and Tiberius, and very little cement seems to have been placed between them. There are some other remains, in different parts of Rome, that seem to be of the same age and construction. Of the brick constructions of the time of Vespasian and his sons, we have some magnificent specimens in the amphitheatre of Flavius, the baths of Titus on the Esquiline, and the villa of Domitian. The two former approach nearer the construction of Augustus, and the latter resembles the brick-work of the palace of Mæcenas. The edifices built in the reigns of Trajan, Adrian, and the Antonines, exhibit the same construction, and though the baths of Caracalla are evidently deficient in good taste and beauty of design, yet the brick-work is nearly equal to that of the best times. After this there was a rapid decline in every thing connected with architecture, and even the brick-work did not maintain its original solidity. They no longer attempted to make them equal in size, and they introduced large portions of cement, which tended much to weaken the strength of the walls. From Caracalla to Diocletian, there are few remains, and even of these we are unable to fix the exact period when they were erected.

It is curious to observe, that they now began to be economical in the use of bricks, and that they introduced a mixture of tuffa, as is evident from the restoration of the tomb of the Scipios, the circus of

Caracalla, and the ruins adjacent to the circus. The numerous churches and basilicos, which were erected by the christians in the fourth, fifth, and sixth centuries, such as St. Croce a Gerusalemme, St. Geovanni e Paolo, St. Paolo, St. Pietro in Vincoli, &c., and the walls which surround Rome on the left bank of the Tiber, and which are of the age of Honorius, exhibit the same poverty of materials; they have bricks of all sizes, with a great quantity of cement, which is of inferior quality to that used in earlier times. On the fall of the Roman empire, they even neglected the selection of proper materials to form their bricks, and even employed those which they took from more ancient buildings. At last they invented a method of cutting the softer stones, tuffa and peperinos, into small rectangular masses, and discarded entirely the use of bricks. The Italians call this *Opera Saracinesca*, because it was introduced when the Saracens occupied Italy. The walls of the Vatican, built by Leo IV. in the ninth century, are the first specimens which we have of it in Rome. This sort of construction continued to be used during the barbarous ages till the fourteenth century; the castle of *Capo de Bove*, near the sepulchre of Metella, built by pope Boniface VIII., is a beautiful specimen of it. They sometimes cut marble in this rectangular shape, as may be seen in *Sorre de' Conti*, a work of Innocent III. of the thirteenth century.

To conclude this part of our subject, we may remark, that the Romans, during the kings, and the time of the republic, employed in the public edifices, square masses of stone; on the decline of the republic, they introduced *opus incertum;* under Augustus, *opus reticulatum* and *lateritium*, were promiscuously used; the *opus reticulatum* ceased under the Antonines, but the brick-work continued to the seventh century, and was succeeded by the *opera Saracinesca*.

We must reserve the observations we have to make on ancient marbles, granites, porphyries, and alabaster, till another opportunity.

[*Edinburgh Phil. Journ.*

Experiments with Bottles sunk into the Sea, made during a voyage from New South Wales. By MR. JAMES DUNLOP, *in a letter to Professor Jameson.*

SIR,—Having on my voyage (*per* ship Portland) from New South Wales, made the following experiments with bottles, &c. sunk into the sea, if you find a description of them to be of service, they are at your disposal.

Experiment 1.—April 9, in lat. 24° south, and long. 43° 10′ west, the ship becalmed off Rio de Janeiro, the boat was lowered down, and rowed a short distance from the ship; the deep-sea lead was let down 80 fathoms, with the following experiments attached to it, consisting of a common porter bottle well corked and pitched over, and secured by a covering of new canvass, which was also covered with a thick coat of pitch; also a tin canister with holes pierced in its bottom, and open at the top, in which were placed four small ther-

mometer tubes, filled with mercury, all of which would burst with a less temperature than 100° of Fahrenheit; also five small glass globes hermetically sealed by the blow-pipe, two of which were vacuum, (or as nearly so as I could make them,) other two were suffered to cool, previous to their being sealed, and the fifth contained a small globule of mercury, to enable me to detect any damp, as an experiment on the porosity of glass; three glass phials, well corked, and firmly secured by leather coverings, tied round the necks, and further secured by a coating of sealing wax, were also put into the canister. After letting them remain ten minutes at the depth of 80 fathoms, the line was hauled in, and the experiments examined. The porter bottle was nearly filled with water, and the cork floating inside; the covering of canvass and pitch was pressed concave into the mouth of the bottle, but the pitch was not cracked or broken. The four thermometers, and also the small glass globes, came up unbroken. I examined the one which contained the small globule of mercury, and it gave not the slightest indications of damp having penetrated through the glass. The three phials came up full of water: of one of them the cork was forced in, and swimming in the water; in another, the cork was forced about half an inch into the neck; and the cork of the third was not apparently affected or displaced in the least degree, although the phial was full of water, and also several pieces of the sealing wax lying in the bottom, which by no means could have got into the bottle, but by the cork being driven in. The wax on the top of each was broken or cracked in regular concentric rings from the centre, and the coverings of leather burst, as well that in which the cork was not displaced, as in the others. Indeed, the hole in the leather which covers the phial with the remaining cork, is larger than in the others, in which the cork is driven in; which, in all probability, may be accounted for, by considering this cork to have been tighter fitted into the phial, and requiring a greater force to displace it: there would be a greater rush of the water into the phial, and the cork forced again into its neck. I think it more than probable this has been the case, otherwise the bits of sealing wax could not have got into the phial had the cork retained its situation; neither could we account for the bursting of the leather and wax which fastened down the cork.

In preparing for the second set of experiments, I attempted to guard against the possibility of the corks being forced in, or the pressure of the superincumbent column at all affecting the corks. I prepared two (four or five ounce) phials: the corks were dipped in strong gum dissolved in ether, and thrust into the mouth of the phials; they were allowed to remain in this state for several days to dry. The corks were then cut close to the mouth, and covered with several thick coats of varnish, and afterwards covered with leather firmly tied round the neck, which was also covered or soaked in varnish, and suffered to dry; and for farther security, the heads and necks of the phials were immersed in brass caps, filled with melted sealing wax, to prevent the possibility of pressure upon the corks. I also prepared a small phial, by simply thrusting in the cork

as tight as possible, and cutting it close to the mouth, and afterwards covering the mouth and neck of the phial one-fourth of an inch thick with black sealing wax. On the 15th May, in lat. 5° north, and long. 26° west (the ship becalmed,) these three phials were wrapped in old canvass, and, together with the thermometers and glass globes used in the former experiments, were all put into a tin case, open at the top, and fastened to the line just above the lead: a porter bottle, fitted up as formerly, was also attached to the line. The boat was rowed a short distance from the ship, and the lead let down 180 fathoms, and allowed to remain about eight or ten minutes at that depth before we commenced hauling in the line. On examining the experiments, the two (five ounce) phials, which were secured by the brass caps, were broken or crushed to powder, with the exception of the thick part of the bottom, and the neck, which was protected by the brass caps. The other small phial, which was much stronger in the glass, and only secured by the cork, covered one-fourth of an inch thick with sealing wax, was not broken or injured in the least, though a very minute quantity of water had found its way into the phial, probably through the wax and cork, and I have no doubt, had the phial been allowed to remain sufficient time at that depth, that it would have filled with water, probably without breaking the wax, or forcing in the cork. Neither the thermometers nor the small glass globes were broken, nor could I perceive the slightest appearance of damp in the small globe which contained the globule of mercury, to indicate porosity in the glass. The porter bottle came up full of water as formerly.

The porter bottle in this, and also in the other experiment, was prepared by captain Mood, commander of the Portland, who assisted and gave every facility for making experiments, when the weather and circumstances would permit.

My object with the thermometer, was to ascertain whether an increase of temperature took place at a considerable depth in the ocean; and not being provided with a self-registering thermometer, the only resource I had was to make several about three inches long, and by immersing the bulbs in water heated to a known temperature, the superfluous mercury was forced out, and the moment it began to subside, the tube was sealed by the blow-pipe. The one which indicated the lowest temperature, required about 73° or 74° of Fahrenheit to raise the mercury to the top of the stem; but experiment proved the unsatisfactory results I might have expected, as it required a temperature above 80° to burst the slender bulb. The experiments of captain Sabine and others, prove the temperature of the ocean to decrease at considerable depths below the surface.

I think it can hardly fail to convince any one who makes the experiment of sinking bottles in the sea, and assists personally at the hauling in of the line, that the great force necessary to haul it in must be occasioned by the pressure of the superincumbent column of water. And I have no doubt that the same experiment may be performed, and powerful effects produced, on a bottle well corked and secured, being placed in a cast-iron cylinder filled with water,

and the *force applied by a hydrostatic press*, on the top of a solid piston (which must be well fitted into a smaller cylinder fixed on the top of the larger one,) the piston pressing upon the surface of the water in the small cylinder. And many interesting experiments might be performed in the lecture room, by substituting a very strong cylinder of glass, having its ends ground parallel, and fitted into brass caps accurately ground to fit the outside of the ends of the cylinders, and the bottom of the caps lined with leather, to prevent the pressure of the screws, necessary to connect the caps and keep them water-tight, from chipping the glass. To one of the brass caps must be fixed a well bored cylinder, for the solid piston to slide in, &c. Sea water might be used in the cylinder, with a thermometer to show what capacity water may have to retain its caloric when under a high pressure. Such experiments would be interesting to compare with experiments which have been made on the temperature of the sea at great depths; and also the specific gravity of the water in the cylinder ascertained before and after the experiment, which would probably throw light on the subject of increased specific gravity of water drawn from great depths, and also whether the effects of pressure on water are permanent, and owing to the imperfect elasticity of water. I am, &c. JAMES DUNLOP.

August 25th, 1827. [*Ib.*

Observations on the Cow-tree of the Caraccas. By MR. DAVID LOCKHART, Curator of the Botanical Garden in Trinidad.

I HAVE just returned from an excursion to Caraccas, where I collected the juice of the cow-tree, (Palo de Vaca,) and I have now the pleasure of sending you a phial of the milk, together with a few leaves, and a portion of the root of the tree. The *Pala de Vaca*, is a tree of large dimensions. The one that I procured the juice from, had a trunk 7 feet in diameter, and it was 100 feet from the root to the first branch. The milk was obtained by making a spiral incision into the bark. Carauo, the place where I met with the tree, is about fifty miles east of La Guayra, and at an elevation of from 1000 to 1200 feet above the level of the sea. It is likewise found between Cape Codera and Barcelona. The milk is used by the inhabitants wherever it is known. I drank a pint of it, without experiencing the least inconvenience. In taste and consistence, it much resembles sweet cream, and possesses an agreeable smell. I was so fortunate as to procure some young trees and roots of the *Palo de Vaca*, which I will endeavour to increase, and, if I prove successful, you may expect to have a plant. I am sorry that I was not able to collect any specimens worth sending during my visit to Caraccas, my stay being limited to eight days, six of which were spent in procuring the cow-tree. I, however, picked up a few seeds, which are sown in a mixed state at St. Ann's, and which are likely to afford something interesting. I am glad to hear that botany goes on prosperously in Europe. I am sorry to say, that, during nine years' residence in this

part of the world, I have found very few persons who take an interest in the advancement of science, the principal aim of the people here being to make money in every way they can. For the last eighteen months, from close attendance to the garden, I have had but little time to devote to collecting.

Note by Mr. Don.—I had an opportunity of examining attentively the leaves of the *Palo de Vaca*, and found them to approach very close to those of several South American species of *Ficus*. The disposition of the nerves and veins was precisely similar, which, together with the insertion and consistence of the leaves themselves, appear to justify the propriety of the place assigned to the *Palo de Vaca*, by M. Kunth, who has arranged it in the family of *Urticeæ*, under the name of *Galactodendron utile;* but neither he nor myself have seen either the flower or fruit; so that as a genus, it rests on very insufficient grounds. The tree, however, is evidently related either to *Ficus* or *Brosimum*. The juice contained in the phial sent to Mr. Lambert, had the appearance of sour cream, and, notwithstanding that it had suffered materially from the long voyage, the taste was by no means unpalatable. [*Ib.*

Notice of a patent for Iron Sheathing for Ships, obtained by G. S. Pattison, Esq. *of London. Dated January,* 1829.

[From the London Register of Arts.]

To devise some means of preventing the rapid corrosion and annihilation of the copper sheathing of ships, has, of late years, attracted the attention of our most enlightened chemists. Sir H. Davy having discovered that the action of sea water upon copper was of a galvanic nature, placed small pieces of tin and zinc, in contact with its surface, which had the effect of preventing the oxidation of the copper, owing to its being thereby rendered negatively electrical. Ships were sheathed on this principle, and sent to sea, but they proved to be such bad sailers, that the scheme was soon abandoned. It is true, that the copper was protected by the zinc, from the corroding effects of the sea water, but in thus getting rid of one enemy, it introduced a greater, in those crustaceous animals, the barnacles, which made the good ships, Lightning and Swiftsure, (as Jack would say) move through the water like the stumps of trees.

In copper sheathing that is unprotected, the loose state of the particles of the oxidated surface, either prevent the shell fish from sticking fast, or the oxide may operate as an active poision and keep them off. We have observed the copper of a ship's bottom to be quite clean after a voyage, while the heads of the *cast metal* nails, have had a barnacle stuck upon each of them, as if they had been placed there by art, as ornamental white studs upon a green ground. These nails being in fact an *alloy of copper*, made with *tin* and *zinc*, the adhesion of the barnacles is accounted for. On the contrary, when nails made of *pure copper* are used, we have observed that the bar-

nacles show a decided aversion to them. Had sir H. Davy observed this fact, instead of ourselves, he would immediately have decided upon the utter inutility of the ingenious scientific experiments that have been made under his directions.

Founded upon the same theory of the galvanic influence, it has been reported, that a truly important discovery has been made; namely, that *iron* will not corrode, when "protected," in a similar manner to the copper, by zinc, and that a ship sheathed with iron and little bits of zinc, had been at sea for two years, returning home with a clean, and even bright surface. The discoverer is an American, who has communicated it to professor Pattison, and the consequence is a patent for these kingdoms, the specification of which we have perused, and annex its substance.

The proposed improvement consists in substituting sheets of iron with plates of zinc, attached thereto by rivetting or soldering, for the copper usually employed. The iron plates may be of the usual dimensions of the copper-plates, and for each area of 100 inches in the iron, a plate of zinc, of from $\frac{1}{8}$ to $\frac{1}{4}$ inch thick, equal to 5 inches in area, is attached to the lower extremity of the sheet, so that in sheathing the vessel from the upper part downwards, each succeeding sheet of iron shall be in contact, by lapping over, with the zinc plate of the sheet, immediately above it. Plates of zinc must also be attached to the inside of the sheet of iron, bearing a proportion in area to those on the outside, of 3 to 5. The spikes and bolts by which the sheathing is fastened to the vessel, are each to be furnished with a disc, or washer of zinc, fitting closely to the head, and it is recommended that they be driven *well home*, to ensure perfect metallic contact. The nails employed are to be made concave under the head, and the cavity is to be filled with melted zinc. The proportion of 5 square inches of zinc to 100 of iron, is not insisted on; any greater proportion will be equally effectual, and the zinc may be alloyed with copper, tin, or lead, in the proportion of from 3 to 10 per cent. By this mode of sheathing vessels, it is asserted that the corrosion or oxidation of the metal will be nearly, if not effectually, prevented.

Remarks by the Editor.—The American alluded to in the foregoing notice, is Dr. J. Revere, formerly of Baltimore, but now of the city of New York. This gentleman has been long and arduously engaged in a series of experiments, which have resulted in a complete conviction that perfect success will attend his mode of protection. The papers of Dr. Revere have been for some months deposited in the United States Patent Office, and all the requirements of the law have been complied with on his part, but the issuing of his patent has been delayed at his own request, to enable him to give the utmost precision to his specification. In the meantime, we presume that he has, by an agent, secured his right in England, under a conviction that it would be endangered by delay, as the laws of that country do not require that the patentee should be the inventor, and it has frequently happened that our citizens who have sent to Eng-

land to secure their patents, have found that some *confidential friend*, or active speculator, has been more on the alert than themselves.

We shall publish Dr. Revere's specification as soon as his patent is completed, and sincerely hope that his success may be such as amply to reward him for his indefatigable labours, and give to commerce and the arts, an improvement of inestimable value.

Memoir of the life of Joseph Fraunhofer, and of his great improvements in the Lenses for Achromatic Telescopes.

Of all the losses which science is occasionally called to sustain, there is none which she so deeply deplores as that of an original and inventive genius, cut off in the maturity of intellect, and in the blaze of reputation. There is an epoch in the career of a man of genuine talent, when he embellishes and extends every subject over which he throws the mantle of his genius. Imbued with the spirit of original research, and familiar with the processes of invention and discovery, his mind teems with new ideas, which spring up around him in rapid and profuse succession. Inventions incompleted, ideas undeveloped, and speculations immatured, amuse and occupy the intervals of elaborate inquiry, and he often sees before him, in dim array, a long train of discoveries which time and health alone are necessary to realize. The blight of early genius that has put forth its buds of promise, or the stroke which severs from us the hoary sage when he has ceased to instruct and adorn his generation, are events which are felt with a moderated grief, and throughout a narrow range of sympathy; but the blow which strikes down the man of genius in his prime, and in the very heart of his gigantic conceptions, is felt with all the bitterness of sorrow, and is propagated far beyond the circle on which it falls. When a pillar is torn from the temple of science, it must needs convulse the whole of its fabric, and draw the voice of sorrow from its inmost recesses. To those who have not studied the writings, or used the instruments, of the illustrious subject of this memoir, these observations may seem extravagant and inapplicable; but there is not a philosopher in Europe who will not acknowledge their truth, as well as their application; and there is not a practical astronomer within its widest boundaries, that has not felt the tide of grief for the loss of Fraunhofer flowing within his own circle.

Joseph Fraunhofer was born at Straubing, in Bavaria, on the 6th of March, 1787. His occupations in the workshop of his father, prevented him from giving a regular attendance at the public schools. At the early age of eleven, he was deprived of both his parents, and the person to whose charge he was entrusted, destined him for the profession of a turner; but his weak frame being ill suited to such an occupation, he was apprenticed to M. Weichselberger, manufacturer and polisher of glass, at Munich. Being too poor to pay any

thing to his master, he was taken on the condition that he should work for him six years without any wages.

At Munich, Fraunhofer frequented the Sunday school, but as his attendance was irregular, it was a long time before he learned to write or to count. In 1801, in the second year of his apprenticeship, an accidental circumstance gave a new turn to his fortune. Two houses having tumbled down suddenly, Fraunhofer, who lived in one of them, was buried under its ruins; but while others perished, he fortunately occupied a position to which it was considered practicable to open a passage. While this excavation was going on, the king, Maximilian, often came to the spot, to encourage the workmen and the young prisoner; and it was not till after a labour of four hours that they were able to extricate him from his perilous situation. His majesty gave directions that his wounds should be carefully attended to, and as soon as he had recovered, he was sent for to the palace to give an account of the peculiarities of his situation during the accident, and of the feelings with which he was actuated. On this occasion his sovereign presented him with eighteen ducats, and promised to befriend him in case of need.

Mr. Counsellor Utzschneider, afterwards his partner in the great optical establishment at Benedictbauern, took him also under his protection, and occasionally saw him. Fraunhofer, full of joy, showed him the king's present, and communicated to him his plans, and the way in which he proposed to spend the money. He ordered a machine to be made for polishing glass, and he employed himself on Sundays in grinding and finishing optical lenses. He was, however, often baffled in his schemes, as he had no theoretical and mathematical knowledge. In this situation M. Utzschneider gave him the mathematical treatises of Klemm and Tenger, and pointed out to him several books on optics. Fraunhofer soon saw, that, without some knowledge of pure mathematics, it was difficult to make great progress in optics, and he therefore made them one of the branches of his studies.

When his master saw him occupied with books, he prohibited him from using them, and other persons whom he consulted, did not encourage him to undertake the study of mathematics and optics without assistance, and at a time when he was scarcely able to write. These obstructions, however, served only to redouble the efforts of our author; and though he had no window in his sleeping chamber, and was prohibited from using a light, yet he acquired a considerable knowledge of mathematics and optics, and endeavoured to apply them to his own schemes.

In order to obtain more leisure, he employed the remainder of the royal present in buying up the last six months of his apprenticeship; and that he might gain some money for his optical experiments, he engraved visiting cards, without ever having been taught the art of engraving. Unfortunately, however, the war which then desolated Europe, put an end to the sale of his cards, and left him in greater exigencies than before.

Notwithstanding the kind assurances of protection which the king

had given him, Fraunhofer had not courage to request it, and he was, therefore, compelled to devote himself to the grinding and polishing of glasses, still continuing to devote his Sundays to the study of the mathematics.

Mr. Utzschneider was at this time seldom at Munich, and could do nothing for our young artist; but he recommended him to a professor of the name of Schiegg, well versed in mathematics and natural philosophy, who paid frequent visits to Fraunhofer.

About this time was formed the celebrated establishment at Benedictbauern, near Munich, by MM. Reichenbach, Utzschneider, and Leibherr, and in August, 1804, they began the manufacture of optical and mathematical instruments, which were divided by the new machine of Reichenbach and Leibherr. The whole of the apparatus was made there, excepting the lenses, for they could not procure good crown and flint glass, and wanted also a skilful optician. With this great defect, the establishment would certainly have failed, unless they had endeavoured to supply it.

Mr. Utzschneider now undertook a journey to make inquiry respecting crown and flint glass, and respecting a skilful working optician; but, after all his labours, he was convinced that the new establishment had no alternative but to form an optician within its own bosom. Through captain Grouner, of Berne, he had heard of the labours of Louis M. Guinand, an optician at Brenetz, in Neuchatel, and having received from him some specimens of his flint glass, he was so pleased with them that he paid a visit to Brenetz, and engaged Guinand to accompany him to Munich. As soon as he arrived there, which was in 1805, M. Utzschneider constructed furnaces for carrying on the experiments upon a well organized plan. The first attempt created much expense, on account of the repeated experiments which it required, but it nevertheless furnished several good pieces of both kinds of glass. The optician, Riggl, polished the first lenses in 1806 and 1807. At this period Fraunhofer found himself in a very critical situation. Professor Schiegg always encouraged him to go to M. Utzschneider, but Fraunhofer was long in resolving to do this, believing that the latter had forgotten him, and knowing that he was well satisfied with his own optician.

M. Utzschneider received Fraunhofer in a very friendly manner, and after a short conversation, it was agreed that he should also become an optician in the establishment. Fraunhofer was then employed to calculate and polish lenses of considerable dimensions, which came from the furnaces of Benedictbauern. These lenses were destined for the instruments of the observatory of Buda. It was afterwards agreed to transfer all the optical part of the establishment to Benedictbauern, and to give the complete direction of it to Fraunhofer. Our philosopher had already studied catoptrics, and had even written a memoir on the aberration which takes place without the axis in reflecting telescopes. He showed that hyperbolic mirrors are preferable to parabolic ones, and he also communicated the invention of a machine for polishing hyperbolic surfaces.

He now, however, resolved to give up this branch of the subject, as his time was fully occupied in the preparation of lenses.

One of the most difficult problems in practical optics, is, to give to spherical surfaces the last polish with that degree of exactness which theory requires, because this final operation destroys in part that form which had been previously given to the surfaces. M. Fraunhofer succeeded in remedying this evil by a machine which not only did not injure the fine surface obtained by grinding, but which actually corrected the irregularities committed in the first operation. It has also the advantage of making the result independent of the skill of the workman.

In examining the glass which he used in reference to the undulations and striæ which it contains, he found that, in the flint glass manufactured at Benedictbauern, there was often not a single piece free of those irregularities which disperse and refract the light falsely. Pieces of the same melting had not even the same refracting power, and this was, perhaps, more common in the English and French flint glass. After obtaining these results, Fraunhofer reconstructed the furnaces, procured the necessary instruments, and took the direction of all the meltings.

He had learned from experience, that flint glass could be made so that a piece at the bottom of the pot had exactly the same refractive power as a piece from the top; but his success was of short duration, for the succeeding meltings showed that this was merely accidental. Undaunted, however, by failure, he recommenced his experiments, in which he always melted four quintals at once, and after long and severe labours, he discovered the numerous causes which occasioned his want of success.

As the English crown glass had many undulations and impurities, Fraunhofer resolved to manufacture it also. Difficulties of a new kind here presented themselves, so that he did not partly succeed till after a whole year's labour. He found, also, that with whatever degree of accuracy he followed the theory in the construction of achromatic object-glasses, his expectations were never realized. On the one hand, he was convinced that it was wrong to neglect certain quantities, such as the thickness of the lens and the higher powers of the apertures, merely to obtain commodious formulæ; and on the other hand, there was no exact method for determining the exponents of refraction and dispersion, in the glass used for achromatic object-glasses. The first of these inconveniences he avoided by a new method, in which he neglected no quantity upon which the required degree of exactness depended. Hitherto, achromatic object-glasses had only been calculated for rays proceeding from a point in the axis of the lens, but Fraunhofer considered the deviations from all points situated without the axis, and this is always a minimum in his object-glasses. In this consists principally the difference between his glasses and those made in England.

The difficulty hitherto experienced in determining the refractive and dispersive powers of bodies, arises chiefly from the circumstance that the spectrum has no definite termination, and that the passage

from one colour to another, was so gradual and indistinctly marked, that in large spectra the angles could not be measured with a greater accuracy than from ten to fifteen minutes. In order to avoid this inconvenience, Fraunhofer succeeded, by a very ingenious contrivance, in obtaining homogeneous light of each colour in the spectrum. In these experiments, he discovered in the orange compartment of the spectrum, produced by the light of the fire, a bright line, which he afterwards found to exist in all spectra, and by means of which he was enabled to determine the refractive powers of the bodies which produced them.

By using prisms entirely exempt from veins,—by carefully excluding all extraneous light, and even stopping those rays which formed the coloured spaces that he wished to examine, he discovered that the spectrum was intersected by a great number of black lines parallel to one another, and perpendicular to its length.* In the spectra formed by all solid and fluid bodies, he not only discovered the same lines, (of which he has reckoned five hundred and ninety in all,) but he found that they had fixed positions, and that the distances between them in different spectra, afforded precise measures of the action of the prism on the rays which formed the corresponding coloured spaces. The valuable memoir in which these discoveries are consigned, was published in the fifth volume of the *Memoirs of the Academy of Munich*, for 1814 and 1815, and also in a separate pamphlet entitled *Bestimmung des Brechungs, und Farbenzerstreuungs, Vermogens verschiedener Glasarten.* The writer of this notice had the satisfaction of first translating this memoir into English, and of publishing an abstract of its results in the article *Optics*, in the Edinburgh Encyclopædia.

About this time, in 1817, Fraunhofer was elected a member of the Academy of Bavaria, of which he was an active supporter.

On speculating on the cause of the dark lines of the spectrum, our author was led to consider them as arising from the interference of the rays, and he was induced to make a complete series of experiments on the inflexion of light. These experiments he published in the eighth volume of the *Memoirs of the Academy of Munich*, under the title of *Neue Modefikation des Lichtes durch gegenseitige Einwirkung und Beugung der Strahlen und gesetze derselben.* In these experiments, of which we have given a full account in the article *Optics*, in the Edinburgh Encyclopædia, Fraunhofer employed a heliostate for giving a fixed direction to the solar ray, and he examined all the phenomena through a telescope mounted upon a large theodolite, by means of which he measured the deviation of the inflected light. The object-glass was twenty lines in diameter; its focal length was 16.9 inches, and its magnifying power from 30 to 110. The heliostate was placed thirty-eight feet seven and a half inches, French measure, from the centre of the theodolite. The diameters of the apertures were measured by a micrometer micro-

* About twenty years ago, lines were discovered in the spectrum, by Dr. Wollaston. See *Phil. Trans.* 1802.

scope, which showed distinctly the *two hundred thousandth part of an inch*, and sometimes even half that quantity. All the phenomena which he thus observed and measured, he considered to be perfectly explicable on the undulating system, with certain modifications; and upon these principles he afterwards constructed a general analytical formula, to express these new laws of light. From this formula, it followed that these phenomena would be modified in a manner not only singular, but apparently extremely complicated, if a number of parallel lines could be made so fine, that eight thousand of them were contained in one inch. After another set of experiments, he invented a machine, by means of which he could construct these systems of lines with that accuracy which the theory required. The details of these experiments were read before the Academy of Munich, on the 14th June, 1823, and will be found in this and the subsequent number of this (Brewster's) *Journal*.

M. Fraunhofer, likewise, applied himself to the study of various atmospheric phenomena, such as halos, parhelia, &c., which he published in professor Shumacher's *Astronomische Abhandlungen*, and of which we have given a notice in the last number of this *Journal*, p. 348. (See Brewster's Journal, No. 12.)

Such is a brief sketch of the scientific researches of Fraunhofer, but, valuable though they be, they are in no respect to be compared with his practical labours as an optician. His minor inventions are a new *Heliometer*, a *repeating wire Micrometer*, and an improved *annular Micrometer*. The principal instruments which he has made, are the great parallactic telescope, constructed for the observatory of Dorpat, and of which we have given a full description and a drawing, in No. iv. p. 306, of this *Journal*. The prime cost of this instrument was £950. Its aperture is *nine* inches, and its focal length 13¼ feet. His next great work was another achromatic telescope, ordered by the king of Bavaria, and which has an object-glass *twelve inches* in diameter, and eight feet in focal length, but it is not yet completed. Although engaged in works of such magnitude, Fraunhofer was at the same time carrying on others on a less scale, though not of less importance to science. The Astronomical Institution of Edinburgh, in the year 1825, ordered from him a very large and complete transit instrument, with a telescope eight feet and a half in focal length, and six inches aperture. Upon the receipt of this order, he constructed three object-glasses of these dimensions, one for the Royal Observatory of Edinburgh, another for a heliometer for M. Bessel, and a third as a spare one in case M. Bessel's object-glass should meet with any accident in the bisection; and, fortunately for science, these object-glasses are all completed.

In the year 1820, when M. Reichenbach left the copartnery, MM. Utzschneider and Fraunhofer entered into a new contract for continuing their optical establishment. The former presented to Fraunhofer a share in the concern, equal to about 24,000 francs, so that, from having several other sources of income, he was now comfortable and independent. Inspired by his success and good fortune, all the activity of his mind was called forth, and he took the esta-

blishment entirely under his direction. Since 1817, it had been transferred to Munich, and the business had increased to such a degree, that *fifty* workmen are at present employed.

In 1823, M. Fraunhofer was appointed keeper of the physical cabinet of the academy of Munich, a situation to which a pension was attached. In 1824, after the public exhibition of the great telescope of Dorpat, the king of Bavaria honoured him with the rank of a chevalier of the order of Civil Merit. He was also elected a member of several foreign societies, among which we may mention the Society of Arts in our own city. The university of Erlangen also conferred upon him the title of Doctor in Philosophy.

Thus honoured and respected both at home and abroad, Fraunhofer was enjoying all the happiness which character and reputation and a moderate independence never fail to yield. His mind was occupied with great views of scientific ambition, which he could not have failed to realize, and such was the perfection to which he had brought his art, that he was willing to undertake an achromatic telescope, with an object-glass *eighteen inches in aperture*, and we have now before us a letter in which he fixes even the price of this stupendous instrument. But he was not destined to accomplish so great an undertaking. In October, 1825, he was attacked with a pulmonary complaint, from which he never recovered. The injury which he sustained by the fall of his house, seems to have left some effects behind it, and for several years he had suffered from glandular abscesses. He was, however, seldom obliged to discontinue his labours, and there is reason to think that he suffered from exposure to the heat of his furnaces. His faculties never for a moment left him; and in his few last days, his mind was occupied with the idea of a journey to France and Italy, for the recovery of his health. He was cut off on the 7th June, 1826, in the fortieth year of his age. A few days before this event, he had received from the king of Denmark, the diploma of chevalier of the order of Dannebroga. The whole of the city of Munich took a lively interest in his disease, and felt the most sincere sorrow for his death. The magistrates of the city permitted M. Utzschneider to choose a place for his tomb, and he was interred by the side of the great mechanician, M. Reichenbach, who had died a short time before.

Bavaria has thus lost one of the most distinguished of her subjects, and centuries may elapse before Munich receives within her walls an individual so highly gifted and so universally esteemed. But great as her loss is, it is not rendered more poignant by the reflection that he lived unhonoured and unrewarded. His own sovereign, Maximilian Joseph, was his earliest and his latest patron, and by the liberality with which he conferred civil honours and pecuniary rewards on Joseph Fraunhofer, he has immortalized his own name, and added a new lustre to the Bavarian crown. In thus noticing the honours which a grateful sovereign had conferred on the distinguished improver of the achromatic telescope, it is impossible to subdue the mortifying recollection, that no wreath of British gratitude has yet adorned the *inventor* of that noble instrument. England

may well blush when she hears the name of Dollond pronounced without any appendage of honour, and without any association of gratitude. Even that monumental fame which she used to dispense so freely to the poets whom she starved, has been denied to this benefactor of science, and Westminster Abbey has not opened her hallowed recesses to the remains of a man who will ever be deemed one of the finest geniuses of his age, and who had exalted that genius by learning and piety of no ordinary kind.

Thus neglected and mortified, it is not a matter of surprise that this branch of science and of art should seek for shelter in a more hospitable land, and that the pre-eminence which England has so long enjoyed in the manufacture of the achromatic telescope, should be transferred to a foreign country. The loss of Fraunhofer holds out to us an opportunity of recovering what we have lost, and we earnestly hope that the Royal Society of London, and the Board of Longitude, will not allow it to pass. Great Britain has, hitherto, left the sciences and the arts to the care of individual enterprise, and to the patronage of commercial speculation; but now, when all Europe has become our rivals, when every sovereign, like the Ptolemies of old, is collecting round his throne, the wisdom even of foreign states, is it not time that she should start from her lethargy, and endeavour to secure what is yet left? The British minister who shall first establish a system of effectual patronage for our arts and sciences, and who shall deliver them from the fatal incubus of our patent laws, will be regarded as the Colbert of his age, and will secure to himself a more glorious renown than he could ever obtain from the highest achievements in legislation or in politics. [*Brewster's Journ.*

On the Means of preserving Birds for Cabinets of Natural History. *By* Charles Waterton, Esq.

Abstracted from "Wanderings in South America."

(Concluded from page 36.)

It is now time to introduce the cotton for an artificial body, by means of the little stick, like a knitting needle, and without any other aid or substance than that of this little stick and cotton; your own genius must produce those swellings and cavities, that just proportion, that elegance and harmony of the whole, so much admired in animated nature, so little attended to in preserved specimens. After you have introduced the cotton, sew up the orifice you originally made in the belly, beginning at the vent, and from time to time, till you arrive at the last stitch, keep adding a little cotton, in order that there may be no deficiency there. Lastly, dip your stick into the solution, and put it down the throat three or four times, in order that every part may receive it. When the head and neck are filled with cotton, quite to your liking, close the bill as in nature. A little bit of bees' wax at the point of it will keep the mandibles in their proper place. A needle must be stuck in the lower mandible

perpendicularly. You will shortly see the use of it. Bring also the feet together by a pin, and then run a thread through the knees, by which you may draw them to each other, as near as you judge proper. Nothing now remains to be added but the eyes. With your little stick make a hollow in the cotton within the orbit, and introduce the glass eyes through the orbit. Adjust the orbit to them as in nature, and that requires no other fastener.

Your close inspection of the eyes of animals will already have informed you, that the orbit is capable of receiving a much larger body than that part of the eye which appears within it when in life; so that were you to proportion your eye to the size the orbit is capable of receiving, it would be far too large. Inattention to this has caused the eyes of every specimen in the best cabinets of natural history, to be out of all proportion. To prevent this, contract the orbit, by means of a very small delicate needle and thread, at that part of it farthest from the beak. This may be done with such nicety, that the stitch cannot be observed, and thus you have the artificial eye in true proportion.

After this, touch the bill, orbits, feet, and former oil gland, at the root of the tail, with the solution, and then you have given to the hawk every thing necessary, except attitude, and a proper degree of elasticity, two qualities very essential.

Procure any common ordinary box, fill one end of it, about three-fourths up to the top, with cotton, forming a plane. Make a moderate hollow in it to receive the bird. Now take the hawk in your hands, and, after putting the wings in order, place it in the cotton, with its legs in a sitting posture. The head will fall down: never mind, get a cork, and run three pins into the end, just like a three-legged stool. Place it under the bird's bill, and run the needle, which you formerly fixed there, into the head of the cork. This will support the bird's head admirably. If you wish to lengthen the neck, raise the cork, by putting more cotton under it. If the head is to be brought forward, bring the cork nearer to the end of the box. If it requires to be set backwards on the shoulders, move back the cork.

As in drying, the back part of the neck will shrink more than the fore part, and thus throw the beak higher than you wish it to be, putting you in mind of a star-gazing horse, prevent this fault by tying a thread to the beak, and fastening it to the end of the box with a pin or a needle. If you choose to elevate the wings, do so, and support them with cotton; and, should you wish to have them particularly high, apply a little stick under each wing, and fasten the end of them to the side of the box with a little bees' wax.

If you would have the tail expanded, reverse the order of the feathers, beginning from the two middle ones. When dry, replace them in their true order, and the tail will preserve for ever the expansion you have given it. Is the crest to be erect? move the feathers in a contrary direction to that in which they lie, for a day or two, and it will never fall down after.

Place the box any where in your room, out of the influence of the sun, wind, and fire; for the specimen must dry very slowly if you

wish to re-produce every feature. On this account the solution of corrosive sublimate is uncommonly serviceable; for at the same time that it totally prevents putrefaction, it renders the skin moist and flexible for several days. While the bird is drying, take it out, and replace it in its position once every day. Then, if you see that any part begins to shrink into disproportion, you can easily remedy it. The small covert feathers of the wings are apt to rise a little, because the skin will come in contact with the bone which remains in the wing. Pull gently the part that rises, with your finger and thumb, for a day or two. Press the feathers down. The skin will adhere no more to the bone, and they will cease to rise.

Every now and then touch and re-touch all the different parts of the features, in order to render them distinct and visible, correcting at the same time any harshness or unnatural risings or sinkings, flatness or rotundity. This is putting the last finishing hand to it.

In three or four days the feet lose their natural elasticity, and the knees begin to stiffen. When you observe this, it is time to give the legs any angle you wish, and arrange the toes for a standing position, or curve them to your finger. If you wish to set the bird on a branch, you can, in a moment, transfer the bird from your finger to it, and from it to your finger at pleasure.

When the bird is quite dry, pull the thread out of the knees, take away the needle, &c. from under the bill, and all is done. In lieu of being stiff with wires, the cotton will have given considerable elasticity to every part of your bird; so that, when perching on your finger, if you press it down with the other hand it will rise again. You need not fear that your hawk will alter, or its colours fade. The alcohol has introduced the sublimate into every part and pore of the skin, quite to the roots of the feathers. Its use is twofold. 1st. It has totally prevented all tendency to putrefaction; and thus a sound skin has attached itself to the roots of the feathers. You may take hold of a single one, and from it suspend five times the weight of the bird. You may jerk it, it will still adhere to the skin, and after repeated trials often break short. 2ndly. As no part of the skin has escaped receiving particles of sublimate contained in the alcohol, there is not a spot exposed to the depredation of insects; for they will never venture to attack any substance which has received corrosive sublimate.

You are aware that corrosive sublimate is the most fatal poison to insects that is known. It is anti-putrescent; so is alcohol; and they are both colourless, of course they cannot leave a stain behind them. The spirit penetrates the pores of the skin with wonderful velocity, deposits invisible particles of the sublimate, and flies off. The sublimate will not injure the skin, and nothing can detach it from the parts when the alcohol has left it. All the feathers require to be touched with the solution, in order that they may be preserved from the depredation of the moth. The surest way of proceeding is to immerse the bird in the solution of corrosive sublimate, and then dry it before you begin to dissect it. Furs of animals, immersed in this

solution, will retain their pristine brightness and durability in any climate.

Take the finest curled feather from a lady's head, dip it in the solution, and shake it gently till it be dry; you will find, that the spirit will fly off in a few minutes, not a curl in the feather will be injured, and the sublimate will preserve it from the depredation of the insect. Perhaps it may be satisfactory to add here, that some years ago, I did a bird upon this plan in Demarara. It remained there two years. It was then conveyed to England, where it stayed five months, and returned to Demarara. After being four years more there, it was conveyed back again through the West Indies to England, where it has now been near five years, unfaded and unchanged.

On reflecting that this bird has been twice in the temperate and torrid zones, and remained some years in the hot and humid climate of Demarara, only six degrees from the line, and where almost every thing becomes a prey to the insect, and that it is still as sound and as bright as when it was first done, it will not be thought extravagant to surmise, that this specimen will retain its pristine form and colours for years after the hand that stuffed it has mouldered into dust. Little more remains to be added, except that what has been penned down with regard to birds, may be applied, in some measure, to serpents, insects, and four-footed animals.

Account of French Patents.

French patent, for Five Years, from 9*th April*, 1822. *Granted to* Messrs. Gros *and* Gessionne, *of Paris, for methods of applying Lithographic Subjects on Bags, Pouches, Souvenirs, &c.*

These methods consist in taking any sort of skin whatever, such as those of calves and sheep, Morocco, or varnished, as sold in commerce without any other preparation. These skins are cut into pieces of a size suited to the object desired to be obtained. On every piece, any subject or drawing whatever is painted, lithographed, or engraved separately, and left in black, or coloured afterward at pleasure.

For painting the subjects, such as flowers and landscapes, and for colouring the lithographs and engravings, mineral and vegetable colours ground up with oil, essence of turpentine and other essential oils, and with water, are employed. A spirit of wine varnish is applied afterward, and dried by a moderate fire, or in sunshine. The object of this varnish, is, to preserve the painting, to prevent it from being rubbed off, and to render it very solid and impermeable.

French patent, for Five Years, from 7th June, 1822. *Granted to* Gilles Rene, *Manufacturer, Paris, for the Composition of a Substance fit for Preserving Packing Cloths, Thread, Ribands, as well as Cords and Cordage of every kind, from damp or humidity.*

This composition is obtained by melting together over the fire, one pound of elastic gum, one pound of bituminous tar, two pounds of linseed oil, one pound of fat oil, and half a pound of litharge.

When the whole is melted, take it off the fire, for fear of accident, and add half a pound of essence (spirits of turpentine.)

Patent for improvement and additions. November 6*th,* 1823.

For the addition of new materials to the preceding composition.

Instead of making the composition as above stated, do it in the manner following:—

First, melt together over the fire, one pound of elastic gum, (Indian rubber,) one pound of bituminous tar, two pounds of linseed oil, one pound of fat oil, half a pound of litharge, one pound of salt of saturn, one pound of alum, and one pound of manganese.

Take it off the fire, as before, and add half a pound of essence (oil of turpentine.)

French patent, for Five Years, from 21*st September,* 1822. *Granted to* Michel Schelheimer, *of Paris, for the invention of a process of Painting under Plate-Glass,* (*sous glace*) *and Common Glass, applicable to optical mirrors.*

The colours in use in this kind of painting, are, mineral silver-white, mineral chrome yellow, Prussian blue, soot-black, vegetable rose-coloured carmine, mineral vermilion red, and mineral umber earth: all these colours are ground in fat varnish.

When the subject has been drawn, the painting is begun with the tints of light, which are made with white, yellow, carmine, blue, and gamboge yellow (*gomme gutte,*) which are transparent colours.

To represent a butterfly, for example, all the transparent colours are applied according to the proper gradations, and we finish with the darker colours, to bring out the light tints.

If it be a rose we intend painting, a very light tint is laid on first, and the shades are laid on afterward, with darker carmine.

For all subjects, such as flowers, fruits, birds, butterflies, arabesques, &c. we always begin with the transparent colours; and finish with the suitable dark shades.

To compose the green colours, Prussian blue and chrome yellow are mixed together in quantities, depending on the shade required.

When it is desirable to throw certain lights into the work, they

are scratched out by means of an iron point, especially in the green leaves requiring high finishing.

After the painting is applied, we lay on a course of silver-white, ground with gum and water.

With respect to plate glass and mirrors, when painting is applied upon them, they are tinned or silvered afterward, as usually done for other objects of this kind.

French patent, for Five Years, from 27th September, 1822. *Granted to* M. Michon, Sen. *of Melun, (department of the Seine and Marne,) for the invention of methods of making men and women's Hats of Plaited Straw, Twigs, and Whalebone, without seam.*

These hats are formed of a tissue, the chain of which is of whalebone, made thin by means of a sort of plane, composed of a piece of wood 3 inches long by 2 inches wide, in which a sharp plane-iron is lodged.

The shoot, weft, or filling, is of twigs or of straw. The twigs are split according to the form intended to be given to the texture, and are prepared in the same manner as the whalebone. As for the straw, it is split by means of an ivory or steel knife.

The hats are made by hand upon wooden forms, and when they are terminated, those which are intended for men are dyed black or gray, and those for women remain undyed. Women's hats are most commonly filled with straw, or with ends of ears, (*bouts d'épis.*)

The same process may be followed for preparing *shakos* for the use of soldiers.

Improvement and addition, 28*th December,* 1822. *Granted to* A. De Barnardiere, *Assignee of Michon's Patent.*

These improvements consist in introducing, in the preceding mode of manufacturing, the method of weaving twigs in flat breadths (*éclisses*) of making hats with a shoot of willow plait, or poplar, or generally of every sort of green or dry wood; and, lastly, of the application of these different tissues to the preparation of shakos, and other head dresses, as well for the civil as the military.

As to the preparation of the different raw materials, that is precisely the same as in the patent granted to Monsieur Michon.

French patent, for Five Years, from 31*st July,* 1823. *Granted to* M. Boullay, *Cutler to the Royal Veterinary School of Alfort, for a Method of Manufacturing Razors, with economy and despatch. Annulled by Ordinance of the King, September* 16, 1825.

Process.—The razor blades, prepared at one heat, are cut out by a fly-press and a matrix.

The backs of the razors are of iron or steel wire, cut of the length of the back of the blades, which requires no alteration. The groove in which the blade is fitted is made with a countersink, and one heating is afterwards given to the heel.

By these means a razor may be completed in an hour, will come much cheaper than those which are made by the usual methods, and may be of a cast steel of the best quality.

French patent, for ten years, from 24th January, 1818. *Granted to* Messrs. MICHAUD, LABONTE & DEPUIS, *of Paris, for the invention of a method of Plating Copper* (cuivre) *with Platina.*

TAKE 123 grammes (= 1899·6 grains) of fine silver, which you are to prepare for solution by the addition of 490 grammes (= 7567·6 E. grains) of nitric acid at 48°. (= 1·50 specific gravity, at 55°. F.): introduce them into a matrass, and expose it on a sand-bath over a continued fire, till the silver is perfectly dissolved.

Afterward prepare, in a porcelain capsule, 490 grammes of white tartar, and the same quantity of marine salt. When these substances have been pulverized together, pour the solution into the capsule, and stir the whole with a wooden spatula, till a perfect mixture is obtained. This composition is used for preparing the copper intended to be plated: for this purpose, the copper is first cleaned, and this composition is afterwards applied to it to whiten it. This application being made, with the assistance of a flat and very clean piece of cork, upon the metal, the latter is afterwards enveloped by a leaf of virgin silver, and exposed to the action of a well-closed air-furnace. Let it heat to a degree above cherry red. Apply, by means of a burnisher, and rub on the plate without taking it out of the furnace, and this will apply the substance on the copper-plate. When the whole forms only one body, pass it between laminating rollers, to give it the consistency of a solid body. This first operation terminated, the leaf of platina is prepared of the proper size for the copper-plate intended to be covered, so as to envelop it, and both are cleaned with sand, to remove any grease they may have on them, and dried with clean linen, that there may be no moisture remaining. The copper is then enveloped by the platina foil, in the same manner as it was before enveloped by the leaf of virgin silver, and submitted to the action of the same furnace as before, rubbing also in the same way with the burnisher, which applies the platina.

ENGLISH PATENTS.

Patent granted to THOMAS REVIS, *Watch-maker, for an improved method of Lifting Weights.* Dated July 10, 1828.

IN the specification of this patent an apparatus is described of the

nature of a windlass, that is worked by a lever moved upwards and downwards alternately, and is so contrived as to have its barrel, or cylinder, (on which the acting cord or chain is wound up,) turned round always in the same direction by that movement.

This apparatus consists of the barrel mentioned, sustained horizontally on an adequate axle in the usual manner, parallel to which, two other axles are supported on the same frame work, having toothed wheels at their opposite ends; two of these are fixed to the axles, and interlock with each other, while the two others turn loosely on them, but interlock with another toothed wheel, that is fixed to the axle of the barrel at the same side of the frame; close to each of the loose wheels a ratchet wheel is fixed to the same axles, and four spring catches being fastened, at equal intervals asunder, to the sides of each of the loose wheels, in contact with the ratchets, on one of the axles being turned, (by raising a lever, fixed to a part of it that projects beyond the frame for that purpose,) the ratchet wheel on its other end passes by the four catches on the adjoining loose wheel to take a more advanced gripe; while the other parallel axle being at the same time turned by it in the opposite direction, by means of its fixed wheel, its ratchet wheel is thereby moved round against the direction of the catches on its loose wheel, which latter consequently becomes attached to it, and being thereby made to revolve along with the axle, it acts on the toothed wheel of the barrel, and causes it to wind up a portion of its cord or chain.

On the other hand, when the lever is depressed, the ratchet of the primary axle presses against the catches of its loose wheel, and causes the latter to act on the toothed wheel of the barrel, so as to make it revolve in its original course, while the ratchet of the secondary axle passes by the catches of its loose wheel, and advances forward preparatory to the next reversed movement of the lever: by this means the barrel continually revolves the same way, while the lever is moved up and down; being only subject to a momentary suspension of motion, while the direction of the lever is being changed.

As for several purposes, it is desirable that weights should be lowered safely by the apparatus, as well as raised; this is effected by a common resisting or friction wheel, over which a band passes, attached to the main axle, capable of being pressed down forcibly by a lever affixed at one extremity; and the primary moving axle being constructed so as to slide a small space laterally, when pressed by a third lever, fixed close to it in the frame for that purpose, this operation causes its fixed wheel to pass beyond that of the secondary axle, and its loose wheel beyond the fixed wheel of the barrel, so that the latter, becoming thus disengaged from the other machinery, is only restrained by the resisting or friction wheel; which the lever attached to its band easily regulates, so as to permit it to recoil, and let its cord be drawn off by the descending weight with a duly restricted degree of velocity.

The primary lever is balanced by a weight on an arm, that projects from it at the opposite side of the axle, to make its action more uniform, particularly in heavy machinery.

Obs.—This apparatus is calculated for raising weights of a magnitude, to which the common winches on the axles of cranes would not be adequate; and in our opinion, the levers (which alone can therefore be applied on such occasions) are made in it to produce a continuous motion, equal in all respects to that produced by winches, in a very ingenious and effectual manner. And we think that windlasses made on this principle would be very serviceable in ships, when furnished with more levers (easily added to the several ends of the axles) and with cross bars, to admit several men to operate on them simultaneously.—[*Repertory*.

Patent Granted to John Hawks, *Iron Manufacturer, for an improvement in the construction of Ships' Cable-Chains, and Hawser Chains.* Dated July 10, 1828.

This improvement consists in making the extremities of the links of those chains, where they touch each other, considerably thicker than their sides, so as to render them more durable than common links.

Links of this kind are to be made by forming bars of iron, or other proper metal, with thicker projecting parts at such regular intervals from each other, as the size of the intended links demands, either by means of rollers, properly constructed, or by swageing, or stamping, and then cutting them obliquely in the middle between every second pair of projections, bending these pieces round into the form designed, and after that, welding their obliquely-cut ends, brought together so as to form one of the sides of each link; all which operations are to be performed by the usual tools and methods.

The patentee states, that links of this kind may be made with, or without *stays*, whichever is preferred; these stays consist of pieces, passing across the shorter diameters of the links from side to side, for the use of which a patent was formerly obtained, that is probably since expired.

Obs.—We think the mode of forming links for chains, for which this patent has been granted, to be a very obvious and beneficial improvement, when these are of an oval form; as it is evident, that links of this shape must be much more liable to wear at the extremities of the longer axle of their ovals, where they rub against each other, than in any other part, and that therefore, the making those parts of contact thicker than the rest, must cause them to last proportionably longer, and that chains composed of such links will be also stronger and more safe than those of the ordinary construction.

It also appears to us, that a secondary advantage, not noticed by the patentee, will arise from this method of forming the links; proceeding from their being necessarily welded at their sides, instead of

at one of their ends or smaller bends, as is customary in making common chains; which alteration, in our opinion, will also make them much stronger, since the welded part will be in general the weakest part of the link, and the forming this connexion in the side where they are least liable to wear or strain, will produce the effect mentioned, as the resistance from the hooked part of the link to be drawn straight, would in many cases preserve its connexion to those adjoining, even if the welding had failed, so as to have little or no strength.

The stays mentioned by the patentee, we think, had better be omitted in all cases; since they add very nearly a sixth (on a rough computation) to the weight of the link (which in the cable-chain for a man-of-war would amount to a considerable tonnage,) without affording any proportional strength; their only effect being to resist the approach of the sides of the link to each other, that great strains might have a tendency to cause, by drawing its ends farther asunder; which is prevented, without the stay, by the insertion of the portions of the other links that pass through its cavity, while at the same time the oval shape of the link causes the tendency to this accident to be of a very small magnitude.—[*Ib.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN APRIL, 1829.

With Remarks and Exemplifications, by the Editor.

[Concluded from page 58.]

45. For an improvement in the mode of *Measuring and Cutting Boots;* Thomas Howe, Worcester, Massachusetts, April 18.

The boots are to be cut by using metal patterns, of which there are two, made in the shape of the common "crimping forms" used by boot-makers. These patterns are graduated, so that by the same guide the largest and the smallest boot can be cut. To effect this, holes are drilled near to, and at equal distances from, each other, extending inwards from the cutting edge of the pattern, of which holes there are several rows, which serve to mark the leather for placing the pattern to cut according to the size required.

A strap, properly divided, is used to obtain the measure of the foot.

"All I claim in my improvement, is, the holes drilled in the patterns, by means of which boots of the largest as well as the smallest sizes may be cut with one set of patterns."

"The advantages to be derived from my improvement consist in the saving of time, in cutting and fitting the boot to the foot more exactly, and with greater certainty, nothing being left to the judgment, as by the common method; in the fact, that any cobbler may cut a boot that will fit, with the same exactness as that cut by the most skilful in the art."

46. For an improvement in the common *Wool Carding Machine*, in making an endless or perpetual roll, by means of a circular, or transverse doffer; Charles Atwood, Middletown, Middlesex county, Connecticut, April 18.

(See specification.)

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47. For an improvement in the *Cylinder Paper Machine;* Isaac Saunderson, Milton, Norfolk county, Massachusetts, April 18.

A general defect in the paper made upon cylinder machines, is, the inequality of its strength when tried lengthwise and across. This is in consequence of a greater number of fibres running in one direction than in the other, and a consequent want of that perfect interlocking which takes place upon mould-made paper. A part of the present machine is intended to remove this defect. For this purpose there is a "*horizontal whirl wheel*, which plays or revolves under the wing cylinder, so called, upon which the paper forms, and by distributing the current and counteracting the continuous motion of the pulp rising upon the cylinder, improves the quality, and increases the strength of the paper, by casting the fibrous parts of the pulp in every direction, and at the same time throwing the knots and motes on the outward surface of the sheet, (instead of depositing in the body of the paper) from which they can easily be removed without injury to the paper."

The other improvement is "the *sheet forming roller;* this roller is used, and put in the place of the *upper water pressing roller* (so called) of the cylinder paper machines. The sheet is formed on this roller, the circumference of which must be graduated according to the dimensions of the sheet required. The additional kinds of paper that can be made on the cylinder paper machine, by means of the improvement, or invention, of the *sheet forming roller*, and the *counteracting horizontal whirl wheel*, are, press paper, bonnet paper, pasteboard, and band-box paper."

There are eight floats on the horizontal whirl wheel, which are placed obliquely, the more perfectly to agitate the water. The whirl wheel and sheet forming roller constitute the claim.

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48. For an improvement in the mode of manufacturing *Seine Twine, and other Small Cordage*, by machinery, at one operation, called "Pond's Cotton Twine Machine;" Alson Pond, Petersburg, Virginia, April 21.

A machine to perform operations so complex, cannot be understood excepting by drawings with references. The machine in question appears to be as simple as its various operations will admit; and should we learn that, upon trial, it is superior to others intended for the same purpose, we will hereafter recur to it.

There are other patents for laying and twisting at one operation,

but the present does not appear to interfere with any which we have seen. The whole machinery, as applied, is claimed.

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49. For an improvement in the *Paddle Wheels of Steam Boats*, or wheels applicable to other objects, to prevent what is called "back water;" Paul Boynton, Ogdensburg, St. Lawrence county, New York, April 21.

This is a wheel, upon the contrivance of which much thought has been spent, as its construction fully manifests. Its intention is to preserve a vertical position in the buckets of a paddle wheel. Many patents have been procured for this object, and we have before taken occasion to express an unfavourable opinion of the whole of them; not merely on account of their complexity, but because we believe that if the end could be attained without a multiplication of moving parts, it would offer but little, if any, advantage beyond the ordinary paddle wheel.

The present plan is certainly not less complex than some of its predecessors. To move ten buckets there are not many less than 200 moving parts, and this certainly would present some objection both in point of cost, and in liability to derangement.

In several of the plans alluded to, one general principle prevails. The buckets, or floats, have on each end two pivots, inserted into the rims of eccentric wheels, the rims being of equal size, and having their centres one as far below the other as the distance between the two pivots on one end of a bucket. An arrangement of this kind will keep all the buckets vertical throughout their whole revolution. Although the plan before us differs considerably from this, yet a little analysis brings it back to an analogous, if not the same principle.

How far this scheme will obviate back water, we cannot now discuss, but will make a single remark on the subject. Suppose the paddle wheel immersed to the centre of the shaft, the last dipping and rising buckets would then have no horizontal motion whatever, but would offer the same resistance as would a flat board of the same size, fixed to the side of the boat with its surface exposed to the water.

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50. For a *Cylinder Hemp and Flax Machine;* James Y. Watson, John Blossom, and Andrew Burnet, Salem, Washington county, New York, April 21.

This machine is intended for breaking hemp and flax, either before or after being water rotted. Two hollow cylinders, three feet long and four or five feet in diameter, are placed to revolve horizontally, one above the other, and in opposite directions. Their peripheries are fluted, or reeded, and touch each other within half an inch. Each cylinder is surrounded, for nearly two-thirds of its surface, with rollers of four inches diameter, very nearly touching each other, and approaching the large cylinder within one-fourth of an inch. The rollers are capable of receding by the agency of springs,

by which they are borne up. These rollers extend from the top of the upper cylinder, as nearly as possible to its junction with the lower cylinder, which lower cylinder is surrounded by small rollers in like manner, but upon the opposite side.

A feeding apron like that of a carding machine, supplies the upper roller, and a receiving table, or apron, below the lower roller, conducts the material off after it has passed through the rollers.

The machinery must be properly geared, and may be turned by any sufficient power.

The arrangement of the fluted rollers and cylinders, and the steel springs by which the rollers are borne up, form the substance of the claim.

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51. For a *Moveable Cider Mill and Press;* Moses B. Bliss, Pittstown, Kennebec county, Maine, April 21.

(See specification.)

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52. For a machine for *Slitting Tenons, Veneers, &c.*, called the "Vertical Tenoner," and intended for shop purposes; John M'Clintic, Chambersburg, Franklin county, Pennsylvania, April 21.

This machine is furnished with a vertical, and also with a circular saw, either of which may be put in gear, and used. A carriage running upon rollers, receives the piece which is to be tenoned; this carriage has a table framed across it, regulated by a *tail screw*, so as to set the piece to be sawed, without the necessity of gauging. For all but very heavy work, the carriage is drawn up by a weight and pulley; there is a rag wheel, however, which may be used when necessary. The claim is as follows: "running the driving shaft on points, also my plan of fly wheel, also the manner of [fixing the] tail screw, or table, preventing the necessity of gauging, and producing perfect uniformity of tenon, with but little care."

The cases are numerous in which patentees are at a fault to tell what to claim as new in their machines, especially where ingenuity has tortured an instrument into almost every variety of form, for the purpose of obtaining an exclusive right. There are several machines for tenoning, for which patents have issued, the essential parts of which appear to us similar to that in question; and there are in our country ten thousand workmen, who, if required, could make a machine equally suitable for this purpose, without having seen either; and, after all this had been done, there would be very little of *invention*, properly so called, in the whole; but merely a condensation of larger machines, and an adaptation of parts of them to the particular purpose in view.

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53. For a new and useful machine for *Planing Floor Plank, and Grooving and Tongueing, and Straightening the edges of the same*, planing boards, straightening and planing square

timber, &c. &c., called the Cylindrical Planing Machine; Uri Emmons, New York, April 25.

This machinery is confessedly similar to that for which a patent issued to William Woodworth, of Hudson, New York, in December last, Mr. Emmons claiming to be the true and original inventor; the correctness of this claim is in a fair way for investigation before the proper tribunal.

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54. For a *Machine for Washing Clothes;* Stephen Hinds, Montrose, Susquehanna county, Pennsylvania, April 25.

We wish it was universally known that all possible washing machines had been long since invented, abandoned, and reinvented, until all conceivable permutations upon every imaginable number of fluted rollers, dashers, rounds, rubbers, and squeezers, had been exhausted. We had rather visit the kitchen on a washing day, than be compelled to describe "a new and useful machine for washing clothes, churning butter, and other purposes, not heretofore known or used." Unfortunately, however, the choice is with the patentee, and the duty of submission with us.

Conceive of two gridirons, hinged together at one end, and you have the form of the washing part of this machine; but, of course, it is made of wood. This frame work is put into a wooden box, with a proper dose of soap suds, and the clothes are placed between the two racks. A lever, like a pump handle, is attached by a rod to the lower rack, which is to be worked up and down until the clothes are completely cleansed. There is no claim, and of this we are glad.

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55. For a *Hemp and Flax Machine;* Thomas Cohoon, Troy, New York, April 25.

There is so much want of clearness in the description of this machinery, which the drawings are insufficient to remove, that we cannot attempt an analysis until we see the model, which has not yet been received at the office. Should it, when it arrives, appear to merit special notice, it shall not be neglected.

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56. For an improvement in the mode of *Manufacturing Salt* from sea water, or salt springs; Henry J. Tudor, Boston, Massachusetts, April 29.

The mode of procedure for which this patent is taken, is designed to facilitate evaporation by solar heat, and seems to be well calculated to produce the intended effect. It appears to us to be new, and is presented in its simple form, without appending to it other claims of doubtful novelty, which patentees so frequently hang as dead weights about the necks of their inventions.

Double inclined planes are to be made, which will appear something like the roofs of rope walks. They may be covered with hydraulic cement, &c. or may consist simply of boards, of from 4 to

10 feet in length, running from the ridge to the eaves. The salt water is to run slowly down these, into proper gutters. In order to distribute the water upon them, there is a gutter of wood which surmounts the ridge, and this is to be filled with the salt water. Gunny bags, or any suitable kind of cloth, or other material, is used to distribute the water from the gutters upon the inclined planes; one edge of a strip of cloth lying in the water, and the other, with a ravelled edge, hanging over on to the inclined planes. The water is thus carried over by capillary attraction, and the quantity may be graduated to the weather, according as evaporation goes on more or less slowly; this is effected by allowing the water in the troughs to stand at different distances from the top. In this way brine of the same strength may be obtained whenever evaporation goes on, the quantity only being varied according to the heat and dryness of the air.

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57. For a machine for *Sifting Grain, Flour, Rice, Flaxseed, and other Seeds*, and separating all sorts of materials which are capable of separation by sifting; John Nichols, Boston, Massachusetts, April 29.

Three or more wire sieves, the frames of which form quadrangular boxes, are placed side by side, over a common box, or trough. A horizontal crank shaft, with three or more cranks on it, corresponding with the number of sieves, carry connecting rods, or pitmen, which move the sieves alternately backwards and forwards. This constitutes the whole of the machinery, which will undoubtedly operate very well. Were we desirous of using such a machine, we should even now scarcely think it necessary to buy a right; and had we *invented* it before the present patent was obtained, we should not have claimed an exclusive privilege; lest, the first wheat fan which we saw might contain a sifter with a crank, or some similar, motion.

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58. For an improvement in the construction of hose, for the purpose of supplying and distributing water to sails, or sheets of cloth, for the *Protection of Buildings from Fire*, called the "Fire Screen;" Caleb Pierce, Salem, Essex county, Massachusetts, April 29.

A common leather hose is to be perforated with holes, a few inches apart; the extreme end of this hose is to be closed, and a sail, or sheet, is to be attached to it for the purpose of retaining the water which passes through the holes. The hose may be drawn up to the eaves of a building, and the sheet allowed to hang at its side, or it may be drawn up to the ridge, and the sheet cover the roof; water is then to be supplied from a fire engine to fill the hose.

We are apprehensive that it will rarely happen that such an apparatus can be fixed and supplied with water, so as to answer the purpose intended. It is easy to try a public experiment with such a contrivance, where all is concerted beforehand; but the anxiety,

hurry, and confusion, at a serious fire, will rarely allow of that orderly and systematic procedure which such an apparatus requires. Where it could be applied, it would certainly be very useful; we are apprehensive, however, that but few rights will be purchased, and, therefore, as a patented invention, it will probably disappoint the patentee.

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59. For a *Machine for Grinding Grain, Paints, &c.;* Henry Averill, Richland, Otsego county, New York, April 30.

This is a conical mill, but differs in several points from such as have been heretofore patented. The conical part, which is the runner, is placed horizontally, being perforated its whole length, to receive an iron axis. The apex of the cone is removed, for three or four inches in length, and its place supplied by a grooved piece of cast-iron. The bed and cap stones lie flat upon each other, being properly confined in their places by iron pins. Each of these is excavated in such a form as to receive one-half of the conical runner. The grain is supplied from a hopper through a perforation extending from the apex of the cone through the cap stone. The inner gudgeon of the axis of the runner passes between the stationary stones at the apex of the cone. Its feed is regulated by a screw at the opposite end, and it may be driven by a whorl and drum, or by gearing in any other way.

It appears to be a simple and economical mill, and we should apprehend that it is very superior to several which have been introduced for domestic purposes.

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60. For an improvement in *Power Looms*, which can also be applied to other looms; Amasa Stone, Providence, Rhode Island, April 30.

This improvement consists principally in the manner in which the reed is fixed in the lathe, within which it has a certain play, which is regulated by springs; and also in the means of forming a connexion with, and communicating motion from, the back part of the reed-frame, by the intervention of a strap, lever, and wheels, to the yarn beam. A general idea of the result will be obtained from the concluding part of the specification, which is as follows:—

"In operating a loom with this improvement attached to it, when the lathe is thrown forward, the reed is pressed against the weft of the cloth, and the lathe proceeds on three-eighths of an inch, more or less. This retarded motion of the reed draws upward the strap and wires attached to them and the lever, so that the catches on the upper end of the lever gain a tooth on the ratchet wheel. By this means the ratchet wheel, the large bevelled cog wheel, the small bevelled cog wheel, the shaft, the endless screw, and the yarn beam, are all caused to move."

"The advantages of this improvement, are, that a greater quantity of work can be done with the same labour than without it—that the warp is equably delivered from the yarn beam at all times, with-

out reference to its size—that the weft is equably distributed through the whole length of the warp, and cloth can be woven, close or open, at the option of the manufacturer, and, finally, that the yarn beam will cease to move and deliver the warp, whenever the weft is broken, or out. The weight and thickness of the cloth depend wholly on the stiffness of the springs, or flighters."

"I claim as my invention the connexion of the reed with the yarn beam, and the communication of motion from the one to the other, which *may* be done as is above specified." AMASA STONE.

LIST OF AMERICAN PATENTS GRANTED IN MAY, 1829.

With Remarks and Exemplifications by the Editor.

1. For a machine called "A Wheel and Rest," to be used as a *Hemp and Flax Dresser;* as a *Grain Thrasher;* as a *Grinder of Grain, Plaster, Paints, Barks, Dye-woods,* and other hard substances; as a *Cider and Clover Mill,* and a *Hulling Machine for Barley, Oats, Rice,* &c. &c.; Israel Johnson, junr., Moriah, Essex county, New York, May 1.

The above formidable title precedes a specification of ten pages, not easily epitomized, and not sufficiently interesting to the major part of our readers, to be given at length. The simple intention of the cognomen '*wheel and rest,*' is, that a wheel is to be made to turn in the vicinity of some other body which remains at rest; and it is in the space between these that the article to be beaten, dressed, ground, thrashed, cleaned, hulled, &c. &c. &c., is to be placed.

Some familiar exemplifications of this *new principle* are given; we are told that "this principle is exemplified whenever a revolving body presents an external surface, nearly in contact with the surface of a body at rest;" "a grindstone, as commonly hung in a frame, and an artificial globe with a wooden horizon, offer familiar illustrations. The globe, with the poles in the horizon, moving from west to east, represents the WHEEL, and the east half of the horizon represents the REST, extending from pole to pole. Any or every point of this rest, may be selected as the *working point* of the machine. In like manner, if the grindstone be the wheel, half the frame becomes the rest, or rather *three* rests, one parallel to the axis, the two others at right angles to it, and parallel to each other."

This wheel and rest may form a flax dresser, or a thrashing machine, by having slats on its periphery to break and dress the flax, or to beat out the grain. It may grind by having its face covered with bur, or other stones, properly dressed. The face of the wheel may be covered with tin, or sheet-iron, or with nails, for hulling, grinding apples, &c. &c. The axis of the wheel may be horizontal, oblique, or perpendicular. Wheels performing either of these operations may be placed alone on a shaft, or the shaft may be made long enough to receive the whole of them together.

The patentee says, "what I claim as new, and as my own inven-

tion in the above described machine, with its various modifications, is, the direct application of the wheel and rest, without the intervention of costly and complicated machinery, for breaking and dressing flax, for thrashing grain, for grinding grain, plaster, paints, bark, dye-woods, and other hard substances; for grinding apples, cleaning clover seed, and hulling barley, and the like." He afterwards goes on to tell the *novelty* of all these things, in the mode in which he performs them.

After this exposition, will it not be adviseable for our millers, and other grinders, flax dressers, and performers of the multitudinous operations which have been effected by means of the "wheel and rest," from a period antecedent to the Noachian deluge, to pause and examine, lest they should interfere with newly acquired rights and claims?

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2. For *Machinery for Cutting Veneers in one Continuous Sheet*, called "Burnap's Veneer Cutter;" Caleb B. Burnap, Belfast, Waldo county, Maine, May 1.

The log to be sawed is fixed so that it may be made to revolve on centres like a piece of wood to be turned in the lathe; and, in this situation, is actually turned so as to become truly cylindrical. Circular saws, running upon the ends of mandrels, are placed in a row, with their faces in one plane, and their peripheries nearly touching, so as to cut the cylindrical log longitudinally and tangentially. A traversing motion is given either to the log, or to the frame upon which the saws are placed, sufficient to unite the cuts of the respective saws in one horizontal line.

The machinery to cause the log to revolve with any speed desired, and also to cause it to advance upon the saws, so as to preserve a regular thickness in the veneer, and to vary this thickness as may be desired, is, of course, provided, but need not now be described.

In sawing mahogany veneers, it is found that the mottle, or curl, is not generally developed by a continuous veneer all round the log. There is, therefore, described, one modification of the machinery, which is intended to cut the veneers off in segments of a large curve.

The veneer as it is cut is turned up out of the way of the saws and of their mandrels, by rollers constructed for that purpose.

The claim is to the particular methods by which the foregoing objects are effected. This kind of saw mill we believe to be new, and it is now in successful operation.

The only example with which we are acquainted of producing a similar effect, was the cutting of a large sheet of ivory, probably 16 inches square. This was done by Mr. Joshua Shaw, of Philadelphia, five or six years since. The tusk was sawed round, in Mr. Burnap's manner, but by what kind of saw, and how arranged, we are not informed.

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3. For an improvement in the *Manufacture of Spades and*

Shovels, with newly constructed handles for the same; Harlow Risley, Glastonbury, Hartford county, Connecticut, May 1.

These shovels are to be made of cast-iron, in the same form as those now in use. The top part of the blade is to have a socket cast on it to receive the wooden handle, or shaft. The upper, or bow part, for the hand, is also to be of cast-iron, with a socket for the shaft of wood to pass into.

The claim is, "the making of the blades of cast-iron with a socket on the top; and also the making of the top of the handle of cast-iron, with a socket to be put on or taken off a wooden shaft."

If a patent for making hammers of cast-iron is good, the present may also stand the test. We cannot immediately refer to the case, but are told that where a patent was taken for making mould boards of cast-iron, the patent was held to be bad, as it was merely changing the composition of matter, which the law declares shall not be deemed a discovery.

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4. For a machine for *Cutting Cheese Curd;* Anson Morris, Henderson, Jefferson county, New York, May 2.

A frame of wood is made so as to form the sides and ends of a shallow box, about ten inches square. This is divided into small squares of about $\frac{7}{16}$ of an inch each, by putting in partitions of tin, placed edgewise, these edges forming the cutters. Upon this lattice work, the curd, divided into thin sheets, is to be placed; a lid, hinged to one edge of the box, is then brought down, which presses the curd upon the cutters, and divides it into small pieces.

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5. For a mode of *Operating by Wind Power upon Machinery* for grinding and bolting grain, or for other purposes; David M'Coller, Hudson, Portage county, Ohio, May 2.

A square building is erected, each side of which is formed of folding doors. In the centre of the roof, or upper part of this building, there is a sort of cupola, or hollow cylinder, in which the wind wheel is contained, which operates like a common oblique leaved ventilator, or a smoke jack; its wings, or leaves, being placed at such an angle as shall be operated upon with the greatest power. From the centre of this wind wheel the shaft descends, which is to give motion to the grinding machinery.

When the mill is to be set in motion, the doors opposite to the quarter from which the wind blows, are to be opened, those to leeward being kept closed by weights and pullies, to give a free passage to the wind when too strong.

The claim is to a wind mill so constructed.

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6. For a *Cylindrical Rail-way Carriage;* Peter Fleming, Civil Engineer, New York, May 4.

Were we writing for southrons only, who are acquainted with tobacco rolling, we should compare this carriage, in its structure and

operation, to a hogshead of tobacco, prepared for rolling; requesting at the same time, to be freed from the suspicion of intending to disparage an invention in which much ingenuity and skill are displayed, by using a homely comparison. The carriage is a cylindrical body, which may have an axis passing through it, or gudgeons affixed to, and projecting from, its ends, for the purpose of drawing it. The wheels are iron rims placed around the cylinder so as to encompass it like hoops; these stand at a proper distance from each other, to run upon the rail; they are provided with flanches, or have their faces finished in any form suitable to the rail upon which they are to run. In the inside of the cylinder may be stowed boxes, barrels, bales, or other goods to be transported. When bars of iron, lumber, or other articles of considerable length have to be carried, the traction is performed in a different way; the carriage is then a hollow cylinder, not furnished with ends; the iron bars, boards, or plank, are passed entirely through it, and, of course, do not admit the employment of an axle, or gudgeons. In this case an endless rope is passed round the middle of the cylinder, which is furnished with double rows of pegs to form a groove, or checks, to retain the rope, or band, in its proper place. This rope also passes over a pulley, which is attached to the horse, or other drawing power, so as to work like the large and small wheels of a lathe with their bands. Two, three, or more cylindrical carriages may be made to follow each other, when connected by bands in the same way.

Under this arrangement it is evident that whatever is carried, must roll with the carriage, but in transporting some kinds of goods, and particularly in carrying *persons*, this would, to say the least of it, be very *inconvenient*. To obviate this objection, a second cylindrical body is placed inside of the first, and is made sufficiently small to revolve within it. This is suspended upon the axis, or gudgeons, and is weighted on one side, so that whilst the outer cylinder rolls upon the road, the inner one will not revolve with it. It is proposed sometimes to make this suspension by the agency of friction wheels, so as to leave but little more friction than that which results from the rolling of the carriage. The patentee says:—

"What I claim is the use of a cylinder, or other volume of revolution, on a rail-way, as a carriage, or vehicle for transportation."

"I also claim as my invention the use of the endless rope in the manner above described, for progressive motion. By means of this use of the cylinder and traction rope, friction is saved, or avoided, to a greater degree than by any machine now known. The traction rope may be employed separately from the cylindrical rail-way carriage, in any other machine where similar progressive motion is required."

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7. For an improvement in the mode of *Manufacturing Paper by Machinery*, by means of an additional machine, called the AGITATOR; Reuben Fairchild, Trumbull, Fairfield county, Connecticut, May 4.

This invention is intended to obviate a defect in the paper made upon the cylinder machines, it being very easily torn in one direction, although strong in the other; this results from the fibres of the pulp being mostly arranged longitudinally with the length of the sheet, whilst in the hand-made paper they interlock equally in all directions. The *agitator* is a semi-cylindrical cradle of metal, which lies under the cylinder in the vat, the bars of metal of which it is formed running in the direction of the circumference of the cylinder, and at a small distance from it. By means of the crank motion, the agitator is made to vibrate in the direction of the length of the cylinder, whilst the latter takes up the pulp; and in this way the fibres are to be made to interlock as effectually as in paper made in a mould. The claim is to the agitator.

A second application for a patent was made whilst the above was pending, by Messrs. Culver and Cole, of Massachusetts; their machinery was identical in principle with that of Mr. Fairchild. An amicable arrangement was effected between the parties, by which a mutual ownership of the right was established, without the vexation, loss, and delay, consequent upon a suit at law.

A patent was granted to Isaac Saunderson, of Massachusetts, on the 18th of April, for another method of attaining the same end, as may be seen in the account of it in the present number.

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8. For an improvement in the *Machine for Carding Wool*; James W. Shankland, Summerfield, Monroe county, Ohio, May 5.

Accident has prevented an examination of this patent. We will notice it hereafter.

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9. For an improvement in the application of *Felt for Carpeting*; Aaron Byington, Herkimer, Herkimer county, New York, May 6.

The specification is in the following words:—

"This improvement consists in making felt by a carding machine (with a filleting doffer) of width and length required for pieces of carpeting of various patterns, large or small, with the aid of a webbing cylinder, a creeper, and felted in the usual manner."

"After the felt is made, it is dried upon tenter bars, and sheared as cloth, and pressed. It is then printed, dried, and pressed, with a common clothier's press, when it is fit for floor carpeting, or coarse clothing, &c."

"What I claim as my invention, and for which I solicit a patent, is, the application of felt to floor carpeting, &c."

Aaron Byington.

The foregoing patent, it will be seen, is for a purpose similar to that of Mr. Harrington, which issued on the third of March last, (see page 412, vol. 3.) Mr. Byington, we are informed, claims to be the original inventor; and upon that ground has taken his patent.

Of their respective merits as inventors, we know nothing, but regret that Mr. Byington has framed his description in such a way as appears but little likely to establish his claim, even should it be founded in justice, particularly as there are no drawings, although such are absolutely required by the law.

The editor was superintendent of the patent office at the time the patent was issued, but neither saw the applicant or the papers until several days after the business was completed, or it would, probably, under his advice, have assumed a different form. It was one of those patents very improperly issued by a person who was at that time a clerk in the office, and whose conduct in this particular was mentioned in a note at page 409 of the last volume.

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10. For a *Revolving Four Barrelled Gun,* and improved percussion lock; Henry Rogers, Middletown, Butler county, Ohio, May 7.

The four barrels are formed by boring four holes in a block of brass of about three inches in length, and 2¼ inches square, which block is made to revolve upon a centre, so that each of its perforations may alternately be brought to coincide with the bore of the main barrel. These perforations form the chambers to contain the charges. A percussion lock is adapted to this gun. The specification does not distinctly state the particular improvements claimed. The revolving barrel itself is not new, but in the way hitherto made has not answered the expectations of the inventor, as it soon gets out of order.

A patent for a revolving barrel to contain six charges, was granted to Artemus Wheeler, of Roxbury, Massachusetts, in 1819, and we are informed that 100 rifles upon his plan were made at the United States arsenal, at Harper's ferry; and the same number upon another plan, varying somewhat from Wheeler's; very favourable anticipations were formed of their utility, but from corrosion of the metal where the barrels unite, or from other causes, a part of the charge soon escaped at this juncture, and they were all laid aside.

The present patentee states that eight shots can be made in a minute, and that one gun which he has tried, exceeds his most sanguine anticipations; it is not, however, during the honey moon that the question is to be decided whether all will "wear well."

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11. For an improvement in *Guns and Fire-arms,* which improvement consists in a priming head and cap, applied to guns and fire-arms, for the purpose of priming and giving them fire, by the means or use of percussion, fulminating, or detonating powders; Joshua Shaw, Philadelphia. First issued June 19th, 1822, surrendered for the purpose of correcting the specification, and re-issued May 7.

We expect a further communication from this gentleman on his mode of using percussion powders, &c. which will probably convey

all the information desired respecting this improvement; we shall, therefore, at present, omit entering upon the subject.

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12. For improvements in the art of *Sawing Boards and other kinds of Lumber,* and in the construction of saw mills, crank wheels, and gearing; Israel Johnson, jun., Moriah, Essex county, New York, May 7.

1st. The saw frame is to be made lighter than usual, say of 3 by 4 scantling; it is to be framed together by four cross pieces instead of two, the pair at top, and at bottom, to be each about two feet apart, with braces of wood or iron to stiffen them.

2nd. The pitman is also to be made light, with a brace from each side extending up to the bottom rail of the saw frame; this rail consequently working on three joints, or noddle pins.

3d. The crank wheel is to be balanced, that is, a weight is to be put upon the shaft upon the side opposite to the crank. A very great advantage is anticipated from so doing; as the patentee supposes that much power is lost by having to lift the weight of the crank on one side.

4th. Spring poles are to be made to operate upon the pitman. These are greatly to relieve the crank, not only in its labour of passing the dead points, but to co-operate with the power, both in raising and depressing the saw gate, or frame.

5th. A *veneer saw wedge* is to be fixed upon a thin saw plate. This wedge is a strip of iron the length of the saw, and is to be fixed upon that side of it next to the veneer. It is made wedge-shaped, its edge being placed towards the teeth, and its thick part towards the back of the saw. This is to give stiffness to a thin saw, and cause it to run as truly as a thick one. The wedge turns off the veneer, or other thin stuff which is being sawed.

6th. A horizontal circular saw running upon a vertical axis is proposed to be used. The description of this is not very clear; but it seems to be intended to cut veneers, &c. from the upper surface of a log placed upon a carriage, or from two logs at once, it being placed between them. A circular *veneer saw wedge* may be used to give it stiffness.

7th. Instead of cog wheels, friction wheels, or rather faced wheels, without teeth, turning each other by their friction, are proposed to be used for saw mills, and other heavy gearing.

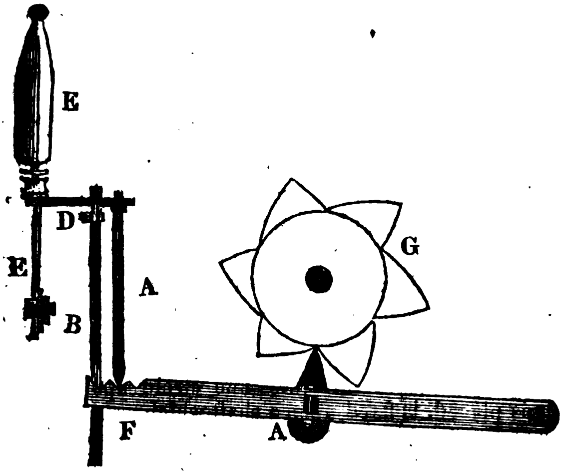
The claim is to all these, and we fear, therefore, that it is too broad. Cranks have been balanced a *thousand and one times;* faced wheels to work by their friction are acknowledged not to be new, but are claimed as applied to heavy machinery. *Query,* at what increase of size does an old contrivance become a new invention? The *veneer saw-wedge* for a straight saw, appears to us to be the best of these arrangements, but if not found in good company, its influence will not be sufficiently redeeming even to save itself from legal condemnation, whatever may be the goodness of its physical properties.

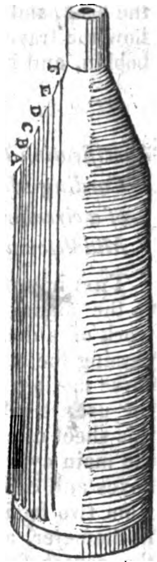
Specification of a patent for an improvement in the manner of forming the Spire, or Roll of Yarn, on a Weaver's, or Shuttle Bobbin. Granted to JOHN THORP, *of Providence, Rhode Island, March* 18*th*, 1829.

THE usual method, now practised, of forming the roll of yarn on a shuttle bobbin, is, to begin at the head of the bobbin, and fill it to its full diameter, and then proceed onward towards the point of the bobbin, keeping the point of the yarn all the way in a conical shape; this is done by short vibrations of the bobbin-rail, or lifter, (so called,) together with one other slow and regular motion moving the bobbin downward, as it fills with yarn. And when the bobbins are filled to the point, or, in other words, when the bobbin-rail has fallen to its lowest position, the machinery then requires to be placed back again as it originally was, at the commencement of filling the bobbin; consequently all the bobbins require shifting at one time, whether they are full or not; and, in altering the size of the yarn, require an alteration in said regular motion. But, in the improvement, no alteration is necessary, either in the commencement of filling the bobbin, or in the different sizes of the yarn, as the vibrating, or traverse, motion, which spreads the yarn over the bobbins, always traverses the whole length of them, varying only at the point of the bobbin, at which place the traverse motions reach, or extend, one beyond another, for six or more vibrations in succession, and then returning, alternately forming a conical point to the spire of the yarn. This motion and manner of filling a bobbin, is nearly the same as that used in the common throsel or spinning frame, (excepting that the bobbins are filled moderately tapering, and with the above described variations.) There are various ways to produce the above described variations in the traverse motion—the following is one selected from a number, as being the most handy and convenient, and requiring but little alteration from the common throsel, or spinning frame—that is, to substitute a cam-wheel (in the place of the common heart) of sufficient size to contain on its surface, six or more cams, projecting from the wheel, and acting on the same lever, or levers, which said heart acted on. These cams are similar in shape to the point of a common heart, and are of different lengths, each one projecting further from the wheel, or its centre, than the former, carrying the vibrating, or bobbin-rail, further, or lower down, at one time than at another, forming a conical point to the spire, or roll of yarn, as above described. It is necessary that the point of the yarn should be formed by the points of the cams, so that a quicker motion may be gained, which is necessary in forming such point.

The above described manner of forming the spire, or roll of yarn, on a weaver's, or shuttle bobbin, and the application of the above improvement to the filling frame and throsel, I claim as my invention, desiring an exclusive property therein, and in the application of said invention and improvements to all and any spinning frame, or frames, that are, or may be, constructed for the purpose of spinning on a weaver's, or shuttle bobbin, &c. JOHN THORP.

Fig. 1. Fig. 2.





Description of the Figures.

Fig. 1. Represents a sketch of the lever and appendages of a common heart motion (so called) used in the common spinning frames, for the purpose of elevating, and giving to the bobbin the proper traverse, or vibrating, motions; also of a cam wheel, which is substituted for the common heart, for the express purpose of varying the length of the traverse, or vibrating motions at the point of the bobbin, so that a conical form should be given to the point, or spire, of yarn at that place.

The cams, or projections, of said wheel vary in length; one projecting further than another, from the surface, or centre, of said wheel, producing the above-mentioned variations, forming a conical point to the roll of yarn.

Said wheel is confined to the same shaft to which said heart belonged.

AA, Is the lever and its appendages, which is acted upon by a weight, or spring, bearing it up to said wheel, or cams.

B, The end of the spindle rail.

D, End of bobbin, or vibrating rail, on which the bobbin and whorl sets.

EE, The spindle and can.

F, The sliding bar, to which the bobbin is confined, serving to steady it.

G, The cam wheel.

Fig. 2. Represents a bobbin filled with yarn, and by tracing the vertical line from the head of the bobbin to A, thence back again to the head, and from that to B, and back again, and so on, will show how the traverse motion conducts and distributes the yarn over the bobbin, and how the conical point is formed.

Specification of a patent for an improvement in the Common Wool Carding Machine, in making an endless or perpetual roll, by means of a circular, or transverse doffer. Granted to Charles Atwood, *Middletown, Middlesex County, Connecticut, April* 18*th.*

This improvement consists in passing a sheet of cards transversely to the main cylinder, approximating so near a contact as to do the work of a doffer. This sheet of cards must be a continued sheet, passing the main cylinder either as a circle or a plane, with a transverse motion; and as a circular manner has been found best adapted for use, it will be particularly described. The circle upon which this sheet of cards is placed, is fixed upon a shaft which passes under the main cylinder at right angles with its shaft, and is secured by boxes and caps to the girths of the frame of the carding machine, and from two to six inches from the centre, and is from four to six feet in diameter, and is covered with cards from the periphery towards the centre from four to eight inches, according to the length of the main cylinder, with the points of the teeth outward, and so placed as to present a line of teeth entirely across the main cylinder, and revolving with a slow motion, it takes off the wool as it passes, and carries it round to the comb, which is affixed to a shaft by three arms, and is put in motion by a crank and pitman connected with a stud on the shaft, which causes it to vibrate on its points in two stands, which are bolted to the carding machine in such a manner that the comb will be in a tangent line with the inside circle of the sheet of cards; the vibrating motion of this comb (describing an arch of a circle,) takes off the bat of wool, and delivers it to the condensing machine, which condenses and conducts it to the can for subsequent operation.

These several parts mentioned above are put in motion by belts, or gearing, and from such parts of the carding machine as is most convenient.

The common cylindrical doffer, the common comb, the roller and the shell, are all rendered useless by this improvement. The transverse motion of the sheet of cards on a circle or a plane, across the main cylinder, with the manner of operating the comb, are what is claimed as new, and constitute the invention or improvement for which a patent is now prayed.

Charles Atwood.

Specification of a patent for a Machine for Breaking and Cleaning Hemp and Flax. Granted to Amos Salisbury *and* John C. Langdon, *Troy, New York, April 17th,* 1829.

This improvement is a machine consisting of three sets of rollers, from two to three feet in length, and ten inches, or thereabouts, in diameter.

The first set made with wooden slats, or staves, standing edgewise, mashing into each other, similar to the teeth of wheels, and, in principle, like the fluted rollers.

Each roller is composed of a shaft; two flanches, or heads, into which the ends of the staves, or slats, are fastened; and the slats running parallel with the shaft. The edges, or points of the staves or slats, of the first set of rollers, are one and a half inch distant from each other.

The second set are made in the same way, with the edges, or points of the staves, or slats, at one and a quarter inch distant from each other; the teeth or slats are consequently more in number, and finer.

The third set are made in the same way, with the edges, or points, one inch apart; consequently the teeth, or slats, are still finer than the last.

These rollers are put into an inclined frame by sets; one roller of each set directly above the other of the same set, at right angles to the plane of the machine; the hemp, or flax, to pass through between the upper and lower of each set of rollers.

To the shaft of each of the rollers is attached a cog wheel, which mashes into a corresponding one affixed to each of the adjacent rollers, so that by applying the moving power to either of the rollers, the whole of them are put in motion.

At the most elevated end of the machine is a platform so constructed that the hemp, or flax, laid upon it endwise to the rollers, will, by their revolution, be drawn between them; and, after passing through it, will be received upon a revolving cloth, or apron, at the other end of the machine.

The machine is so constructed as to occupy very little space.

The plan of this kind of roller we conceive is far better than the ordinary fluted roller, for breaking hemp or flax; the staves, or slats, being elastic, suffer the hemp, or flax, to pass through without mashing or tangling; and the spaces between the staves, or slats, and the openness of the roller, permit the shives to separate and fall through.

We propose to construct the staves, or slats, of wood, cast-iron, or wrought iron, according as the one or the other shall be found best to answer the purpose; their width, thickness, and form, may also be varied; the number of rollers, likewise, may be increased.

Amos Salisbury.
John C. Langdon.

Specification of a patent for an improvement in Spinning Cotton Yarns and Roping, which improvement is called "THORP'S RUNNING CAP SPINNER." *Granted to* JOHN THORP, *of Providence, Rhode Island, June* 13*th*, 1829.

THIS improvement in constructing the machinery for spinning, and in spinning cotton yarns and roping, consists of a short conical, running cap, the shape of which is similar to that of a tunnel with its nose downwards, hung and supported at the top of a live or running spindle. The use and functions of this cap, are, to keep the yarn and roping at a proper distance from the bobbin; also, to direct and distribute it thereon. The yarn is not connected with the cap, as in the common flyers, but it is allowed to revolve around the surface of said cap, yielding to the resistance of the atmosphere, causing it to fall back of the cap, and wind on the spool or bobbin, the lower edge of the cap being the guide. The cap should be placed near to the guide wire, so that as little length of the yarn or roping as possible be exposed to the atmosphere. The nose, or shank, of said cap is penetrated by the top of the spindle, which nicely fits it, and is held fast to its place by a screw, or a pin and slot, similar to the common method of fastening a bayonet to the end of a musket, or by a catch like that of a bit stock, or in any other suitable way. The following dimensions are suitable for spinning, on a weaver's, or shuttle bobbin; and when other bobbins are used, the dimensions must be varied to suit them. The whole length of the cap, from the top of its nose, or shank, to the lower edge of its conical part, or brim, should be about two and three-quarter inches, and the length, or depth, of the conical part about one inch. The diameter of its brim should be about an inch and one-quarter. The hole, or cavity, of said cap, after leaving the conical part, should be larger than the bobbin shaft, (which is hereafter described,) and continue of an equal diameter about the distance of an inch and a quarter, in which the top of said shaft will traverse, and the remainder of the nose above is nicely fitted to the top of the spindle, as above described. At the top of the conical part of its cavity are fixed a set of pins, say four, projecting inwards, so that their ends reach the spindle, for purposes hereinafter described. The thickness of the cap should be about the eighth of an inch; said cap may be made of iron, or any hard suitable metal. The spindle, and its situation in the frame, is like that of the common throsel, receiving its motion from the same source as that of the throsel spindle. The length of the spindle above the upper bearing, may be according to the desired length of the bobbin, which for a common shuttle, or weaver's bobbin, ought to be about seven inches. The bobbin (the body or shaft of which is a tube of thin sheet iron, or brass, or tin, or, may be, wood,) traverses on the spindle, and turns with it. Said shaft is smooth on the outside, and its head moveable on its body. The upper end of said body, or shaft, which will remain in the cap, has in it four slots, or mortises, extending down and running parallel with the spindle; in these mortises the aforesaid pins traverse; or, in other words, the mortises give liberty for the bobbin to traverse on the spindle. The pins assist in crowd-

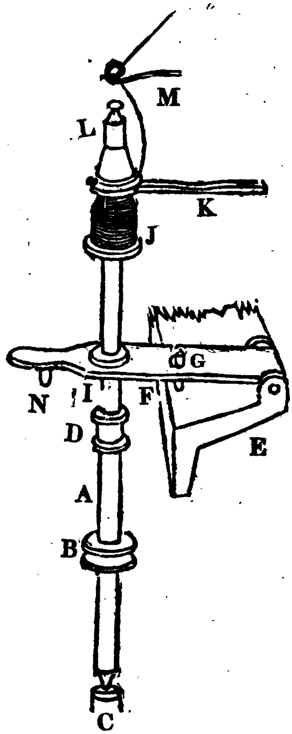
ing, or pressing, the yarn or roping down the bobbin; they also compel the bobbin to turn with the spindle. In the commencement of filling the bobbin, the head is slipped up to the top of its body, (which will be in the cap,) and by means of a spring fixed in the head, and crowding against the body, holds said head wherever it is placed. The head, together with the roll of yarn or roping, is crowded down the bobbin as fast as it fills with yarn—this is effected by the conical point of the roll of yarn, or roping, crowding within and against the conical sides of the cap at every vibration, or elevation, of the bobbin, alternately condensing the yarn or roping, and crowding it down the bobbin, until the bobbin is filled the whole length—the bottom of said body, or shaft, will set on the vibrating rail (or lifter, so called,) and will vibrate for the purpose of forming the said spire or roll of yarn, or roping. Said roll, or spire, may be slipped off from said bobbin, and placed on another of the ordinary kind, or on to a suitable tongue that may belong to the shuttle, and save the expense of fixing more than one set of bobbins in the above described manner. The bobbin, spindle, and cap, all run together, each one performing the same number of revolutions. It is necessary that there should be something to check, or obstruct, the progress of the yarn while revolving, such as the fibres of woollen cloth, or the pressure of a gentle spring touching the said cap. The use of this is to produce a friction on the yarn, causing it to fall back of the cap, and wind tighter on the bobbin; also to prevent the yarn from catching, and winding round said cap. From a number of different ways in which this can be effected, I have selected the following, viz: a thin, flat ring or plate, of iron, brass, wood, or any other suitable substance; the diameter of the hole through it, should be the same with that of the cavity of the cap at the brim, and the diameter of its outer circle, or whole substance, should be greater than that of the outside, or brim of the cap. The flat surface on the upper side of said ring, or plate, should be smooth, or may be covered with cloth, leather, velvet or any other suitable substance; said ring, or plate, is situated under the broad brim of said cap, and its upper surface is pressed lightly, against the lower flat surface of the cap, by a light spring, or weight. Between these two surfaces the yarn revolves, and by increasing or decreasing the pressure, the yarn is made to wind tighter, or not so tight, on the bobbin. Said ring has a broad, thin, elastic arm, or shank, belonging to it, which acts as the spring to press said ring against the cap, and by which the ring is confined to a rail that stretches along the frame, back of the spindles. It is necessary that the ring, or plate, be open in front, so as to give the yarn a free passage to the cap. To mend, or piece, the yarn, the following rules should be observed; the spindle is stopped by taking hold of it below the upper bearing, with one hand, while, with the other, the cap is lifted off, and held between the fingers; and with the thumb and forefinger of the same hand a sufficient length of yarn is drawn from the bobbin, and then the cap is replaced on the spindle, and the yarn cast into the guide wire, and the hand withdrawn from the spindle, and the thread pieced—or, instead of lifting the cap off from the spindle, for the purpose of piecing the yarn, it may

be done as follows, viz: the lifter on which the bobbin, or the bobbin's shaft, or body, sets, may be a spring, or may be constructed with a joint, and a handle in front, which can be taken hold of and pressed down, bringing the point of the roll of yarn, or roping, below the cap, and the upper end of said shaft, or body, below the above mentioned pins, which will allow the bobbin to turn on the spindle, so that the yarn can be drawn off and pieced. When the said lifter is pressed down, it may come in contact with the spindle, and stop it, while the yarn is put in readiness to piece—or said lifter may be held up to its place by a spring catch, and when the catch is withdrawn, the lifter will fall, giving the same opportunity to piece the yarn as above described. What I claim in this improvement as my invention, and in which I desire an exclusive property, is—the short, conical running cap, and the peculiar manner in which the yarn is conducted to the bobbin—the moveable head above described—the method of condensing the yarn, or roping, by crowding it into the cap, as above described—the method of beginning at the top, or point, of the bobbin to fill it, as above described—the crowding or slipping, the roll, or spire, of yarn or roping, down the bobbin as it fills—also the above described manner of producing a friction on the yarn that causes it to wind tighter on the bobbin—and the application of all, or any, of the above stated improvements to any kind of spinning where they may be useful.

JOHN THORP.

DESCRIPTION OF THE FIGURE.

A. The spindle.
B. The whorl.
C. the step.
D. The box that forms the upper bearing to the spindle.
E. The end of the vibrating rail.
F. The lifter.
G. A pin which has in it a notch that holds the lifter up to its place.
N. A pin that is confined to one end of a slide, or spring catch, that works under the lifter, the under end of which catches in the above mentioned notch, holding the lifter up to its place.
I. The shaft, or body of the bobbin.
J. The head of the bobbin, which is moveable on its body.
K. The ring, or plate, that presses up against the cap and yarn, causing the yarn to wind tighter on the bobbin.
L. The running cap.
M. The guide wire.
The yarn is seen upon, and extending above, the bobbin.



Specification of a patent for manufacturing of Shovels of Cast Steel and Iron, or of any other Steel and Iron, by Welding and Rolling the Steel and Iron together. Granted to ELIZABETH H. BULKLEY, *relict of* CHAUNCEY BULKLEY, *of the town of Colchester, Connecticut, February* 28, 1828.

TAKE a bar of iron of sufficient width, when rolled, for the length of a shovel or spade, scarp or slope down one side of the bar. Then take a bar of cast, or any other steel, about an inch square; draw it some, and scarp or slope down one edge; weld it on the face of the bar of iron on the side of the bar that is scarped or sloped down; heat it in a furnace, run it through a common rolling mill, until sufficiently thin for a shovel or spade. Cut up the plate crosswise, of a suitable width for a shovel or spade; shape the shovel or spade in cast-iron *dies;* make the shank of the shovel or spade of two pieces of rolled iron; rivet them on each side of the shovel or spade, with the handle in the middle. The shovel or spade to be ground and polished.

CHAUNCEY BULKLEY.

Specification of a patent for the manufacturing of Scythes by Welding and Rolling Iron and Steel together. Granted to ELIZABETH H. BULKLEY, *relict of* CHAUNCEY BULKLEY, *of Colchester, Connecticut, February* 28, 1828.

TAKE a bar of iron of a suitable size for the blade of the scythe. Hammer it till one side is a little thinner than the other; then take a thin plate of cast steel, and weld it upon the thin edge of the bar, and then roll it down to a proper degree of thinness for the blade of a scythe. Cut the plate, if necessary, into suitable lengths for a scythe, and punch holes in the back edge of the plate; then turn up the back edge of the plate, at a right angle, as high as may be requisite for the thickness of the back; then take the back, which is to be forged of iron, and punch holes through it, corresponding with the holes in the plate. Rivet the back firmly on the plate, then turn the scythe in the usual way. The back must be made so wide at the heel as to admit of the blade being rivetted upon it with two rivets.

The two preceding patents were granted in pursuance of a special act of congress, passed on the 18th of February, 1828. The petition upon which this act was founded, set forth that Chauncey Bulkley had, during his life time, been the inventor of several valuable machines, of the benefits of which he had been deprived, by his generous, but misplaced confidence in others; that he had exhausted his own resources in bringing these inventions to perfection, and had at length been removed by death, leaving his family in a destitute condition, and unable, therefore, to obtain patents for the two preceding improvements.

The petition also states, that the principle of manufacture ex-

plained in these specifications was first applied to hoes, and a patent obtained in the year 1827, by said Bulkley and others, which application has been, and still is, a source of profit to those who took advantage of the necessities of the inventor, but not to himself or his family.

In conformity with the prayer of this petition, a law was passed, ordering patents to issue without the payment of the customary fees.

Specification of a patent for a Moveable Cider Mill and Press. Granted to Moses B. Bliss, *Pittstown, Kennebeck county, Maine, April* 21, 1829.

This improvement consists in combining in one moveable and entire machine, the process of reducing apples to pummage, and of extracting the liquor, by means of a newly constructed vertical wheel for grinding, its combination with other wheels, and the application of these wheels, rack and pinions, for pressing; known by the name of the "Moveable cider mill and press."

The wheel has an axis fastened in its centre, on which it revolves; its periphery is smooth, and its surfaces straight from the centre: on both surfaces are fixed a convenient number of teeth, of steel or iron, projecting horizontally, a proper length to operate on the apples. Over this wheel is a hopper (to retain and conduct the apples) decreasing at right angles with the axis as it descends towards the wheel; on both sides of the wheel, directly over the axis, is a partition, so as to admit the apples to come in contact with either quarter of each side of the wheel. The hopper, together with the wheel, may be placed on the frame of the machine, over a box into which the pummage falls for pressing.

The wheel is to be put in motion by means of a small pulley fixed to its shaft, and a band extending to a horizontal band wheel. On a perpendicular shaft of this wheel is a pinion which mashes into a cog wheel; and a pinion on the shaft of the cog wheel engages with a rack upon the piston. The rack must be disengaged from the pinion by removing a key from behind the piston, when the machine is in operation for grinding, as the piston head forms one end of the box, and must remain stationary when grinding. The power is applied to the shaft of the cog wheel, when a motion is required for grinding, and to the shaft of the band wheel when the pressing is performed; this is done by removing a sweep from one shaft to the other. After the pummage is sufficiently pressed, the bulkhead of the box is removed, and the piston extended to the front of the box, to free it of the pummage. The machine rests on two pair of wheels; one pair being smaller than the other, and adapted to turning, like the forward wheels of a wagon. It may be drawn by cattle by means of a tongue fixed to the axle of the smaller wheels. This mode of

obtaining power and motion, and the manner of moving the machine, has nothing peculiar in it.

A particular description of the frame for supporting the machinery, the dimensions of the wheels, &c., and their positions, is deemed unnecessary, because they may be varied according to circumstances.

MOSES B. BLISS.

On the Strength of Boilers.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

THE pressure of a fluid, in any given direction, on a body at rest in the fluid, is dependent on the transverse section, or base, of that body, perpendicular to the direction of the pressure, without regard to the figure of the body.

We may, therefore, suspend a cylinder for example, under water in a horizontal position, one end of which shall present a cone, and the other a plane, or flat surface, to the water, without any indications of the pressure being greater on the flat end than on the other. We may in like manner suspend a cylinder in air, (or in vacuo,) containing an elastic gas, or steam, one end of which presented to the contained steam, shall be flat, and the other concave, or we may make any other variation in the figure of the ends; but the base, or transverse section, remaining the same in all cases, the cylinder will continue at rest.

It is on this reasoning that a rule is given, and acted on by engineers, to ascertain the force exerted by a fluid (or steam) of a given density, to tear, or rend asunder, each and every part of the circumference of a cylinder in which it is contained. And according to this rule, if a ring, say of 1 inch in width, forming part of a cylindrical boiler, be subjected to investigation, the force exerted to tear asunder each and every part, is equal to the force exerted by steam of the same density on a space, equal in length to the radius of the circle, and of the same width (1 inch.)

The demonstration is as follows. Let the circle in the diagram be a ring, one inch in width, forming part of a cylindrical boiler 20 inches in diameter, and containing steam of 1 lb. to the square inch. Then the pressure on the bases *c*, *d*, and *e*, *f*, equal to the diameter *a*, *b*, will be 20 lbs. each way from the points *a* and *b*, in a horizontal direction, which pressure of 20 lbs. on the *whole* base, requires a resistance of 10 pounds at each end, *a* and *b*, to prevent the boiler from being parted at those points, or according to the rule, "as the pressure on the radius" (10 inches.)

I have been informed that the late Professor Robinson, of Edinburgh, lays down the above law and demonstration. Oliver Evans is likewise of this opinion, and gives in his "Engineer's Guide," a table of the strength of cylindrical boilers of various diameters predicated on it, and remarks, "I have never found a solution of this

so useful problem, that so often occurs in practice, in arranging steam engines, water works, pipes of conduit, &c."

I think I can show a different result from the foregoing, in so plain a manner, that all who read this article, will be able to follow me through the demonstration.

That the greater *motion* of a small force, will, in producing a mechanical effect, compensate for the greater *intensity* of another opposing force, having less motion, is well understood; but that this law, by which motion compensates for intensity, should apply when there is no motion, is not so easily comprehended.

Let it suffice for the present to state the fact, that when two opposing forces balance each other when at rest, the one force is less than the other, as the one *would* describe a greater space than the other, if motion were given to each in the direction in which they act (the relative directions and positions remaining unchanged.)

For instance, a ball is held at rest on an inclined plane, by a given power, acting in the direction of the plane, the resistance or weight is in a vertical direction.

If the ball, in being moved 1 inch up the plane, (the direction of the power) would attain but half an inch in the direction of the resistance, or vertically, the intensity of the resistance to that of the power is both in rest and motion, as 2 to 1.

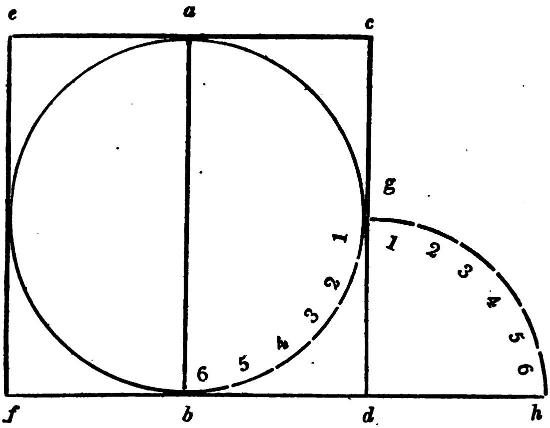
We say of the lever, that "the power is to the resistance, as the distance of each from the fulcrum." Of the inclined plane, that "the power to the resistance is as the length of the plane to its height." Of the wedge, "as the length of the wedge to its thickness." Of the crank, "as cosine to radius," &c.

All of which rules are correct and useful; but the law of motion from which they emanate, and on which they depend, is rarely examined. There are, in consequence, many persons of respectable scholastic acquirements on this subject, who are at a loss when a new case occurs, for which they have no specific rule in their "manual."

Let the circle in the diagram represent (as previously) a ring of 1 inch in width, forming part of a cylindrical boiler, 20 inches in diameter, and containing steam of 1 lb. to the square inch; and it is desired to know the resistance required at the points *a* and *b*, to prevent its parting in a horizontal direction at those points.

As the *whole* pressure tending to part the boiler, each way, from the line *a*, *b*, is sustained at the *two* points, *a* and *b*; it is only necessary to consider a quarter of the circle, say from *g* to *b*, to find the resistance at *one* of the points (as at *b*,) in a horizontal direction.

Imagine the arc *g*, *b*, divided into any number of equal planes indefinitely small, which by approximation we will call No. 1, 2, 3, 4, 5, 6, and that the steam, (or power) acts equally on these spaces in a direction from the centre of the circle. Then describe the arc *g*, *h*, which also divide into a corresponding number of equal spaces, as 1, 2, 3, 4, 5, 6.



Now the equal lengths of the lines in each space of the arc *g*, *h*, express the equal motion, which we may suppose *would* be generated by the several equal powers, and the *direction* of said lines shows the horizontal distance, which would be attained by the several resistances during said motion. Therefore the sum of all the motions (or space passed through) by the several powers, is as the length of the arc *g*, *h*. And the sum of all the horizontal distances, attained by the several corresponding resistances, is as the length of the line *d*, *h*. And, as the resistance must compensate by intensity, for what it is deficient in motion, or in space supposed to be passed through by the power, the intensity of the resistance to that of the power, is inversely as the distance, or line, *d*, *h*, to the distance, or arc, *g*, *h*.

Consequently, the strain to part the boiler, in a horizontal direction, at *a* or *b*, would be as the pressure of the contained steam, on a space equal to ¼th of the circle, instead of on a space equal to the radius. It is not unusual to work steam at 100 lbs. to the square inch, on boilers of 36 inches in diameter.

If we suppose a boiler of this size divided into rings of 1 inch in width, the steam would exert a power, to part each of these rings, of 2827 lbs., being nearly 60 per cent. greater than by the first mentioned method of estimating the force, by which process 1800 lbs. only would be the power exerted to rend each of the rings.

THOMAS W. BAKEWELL.

Cincinnati, 30*th July* 1829,

Remarks on Friction, and on the Power of Heavy Bodies in Motion.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—In some recent discussions of the laws of friction, and also of the power or momentum of heavy bodies in motion, it was urged on the one side, that friction is in the simple ratio of the time the rubbing surfaces of bodies are passing each other, without regard to the distance passed over; and that the powers of heavy bodies in motion are in the simple ratio of their velocity: to which the following observations were offered in reply; if you think them worthy of a place in the journal, you will please insert them. R.

There exists some difference of opinion respecting the laws of friction, as regards the velocity under which it takes place; also respecting the powers of moving bodies, when compared with their velocities.

One of these opinions as regards friction, maintains that it is equal in equal times; the other is, that it is equal in equal spaces.

One opinion maintains that the powers of moving bodies are simply as their velocities; the other, that they are as the squares of their velocities.

As a right understanding of these laws must be exceedingly important in much of the business of life, I have taken great pains to trace the effects which would result from these operations of matter, obeying these very different laws severally, which have led me to the conclusion that the latter is the true law; this will be illustrated, and, in my opinion, maintained by the reasonings which follow. In order to apply these reasonings, it is necessary to establish the principle, that the quantity of resistance opposed to any known power employed to raise a weight to any given height, will be found by multiplying the weight by the height, without regard to velocity; and, that the quantity of force,* as a moving power, that a descending body will produce, will be known by multiplying the space through which it descends by the weight of the body.

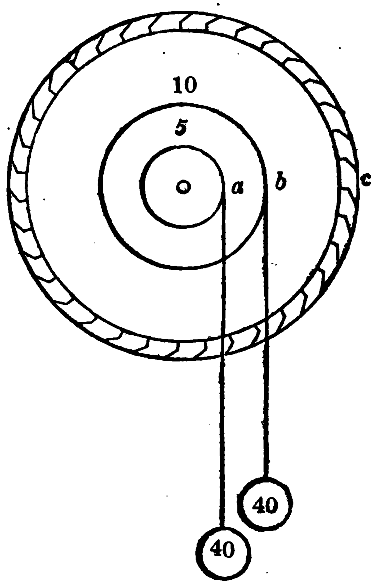
The reasoning employed, and by which it is expected the above propositions will be established, will apply simply to the abstract principle under consideration; (that is,) when I speak of the power of matter acting by gravity, either as a mover or resister, all the attendant collateral principles, such as inertia, friction, &c. will be excluded.

The quantity of resistance, from gravity, of a body to be raised to any height, will be found by multiplying the weight of the body by the height, or space through which it was raised, which is shown by the annexed figure A, representing a water wheel, 20 feet diameter, lifting a weight of 40 lbs. with different velocities; *a* and *b* are two pulleys on the water wheel shaft, *a* is 5 and *b* 10 feet diameter. Sup-

* The quantity of force is used as synonymous with power.

pose 90 lbs. of water to turn the wheel 3 times in 1 minute, and so much to be constantly on the wheel as to require 10 lbs. at *c* to balance it, which is equal to 40 lbs. at *a*. All being adjusted, the wheel is put in motion at the rate of 3 revolutions per minute, the pulley *a* winds up the cord 15 feet each revolution, that is, 45 feet in 3 revolutions, which multiplied by the weight, 40 lb. gives the quantity of resistance 1800. Now 90 lb. of water having descended 20 feet, gives the power expended 90 × 20 = 1800.

Fig. A.



Again, if double the quantity of water be let on the wheel, the weight 40 must be suspended at *b*, where it will balance this double quantity; all being put in motion as before at the rate of 3 revolutions per minute, 180 lb. of water will be expended in 3 revolutions; we then have by the formula, 180 × 20 = 3600, for the power expended, the weight 40 lb. was raised on the 10 feet pulley 90 feet, which multiplied by 40, gives 3600 for the resistance.

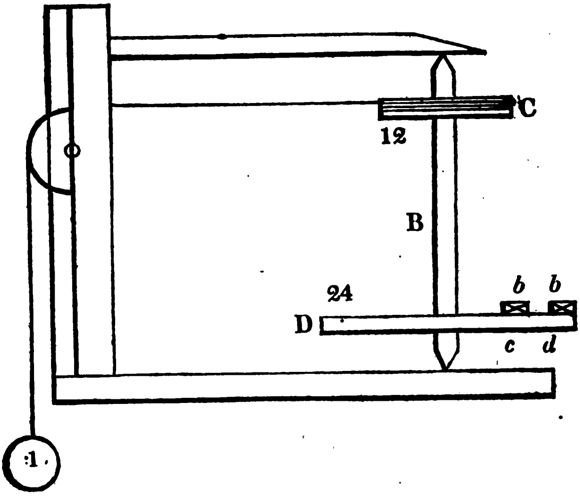
It is consistent with both theories, that the power expended, was, 1st, 1800; and, 2nd, 3600; the velocity of the wheel, and consequently the water, being the same. Then it follows, if the quantity of moving forces were, 1st, 1800, and, 2nd, 3600, the quantity of resisting forces which balanced them must have been 1800, and 3600 also.

That the resisting forces of friction are as the spaces which the rubbing surfaces of the bodies pass on each other, is shown by the annexed figure B, which represents a wheel D, turning horizontally on the vertical axis B, and put in motion by attaching the weight A of 1 lb. to a cord wound round the pulley C on the axis, which pulley is 12 inches diameter.

The body *b*, is placed on the horizontal wheel at *c*, 6 inches from its centre; this body also weighs 1 lb. and its position on the wheel exactly balances the weight A, consequently the measure of its friction or resisting force to the movement of the wheel is 1 lb. because it is applied at the same distance from the centre of the axis, as the cord suspending the weight A. The body *b*, is prevented from moving round with the wheel by a cord attaching it to a pin in a direction opposite to the motion of that part of the wheel. The wheel is then put in motion with a velocity equal to 10 revolutions per minute, the weight A descends 30 feet; we then have by the formula 30 × 1 = 30

for the quantity of force expended, the quantity of friction being the only resisting force, must also be 30.

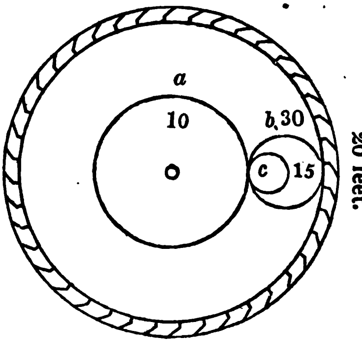
Fig. B.



The weight *b*, is then placed on the wheel at *d*, 12 inches from the shaft, and secured from moving with the wheel as before; it is plain that the weight A, can urge the wheel at this point with no more than half the force with which it acted at the point *c*, in the first case, and consequently requires an additional lb. attached to the cord, when the friction *b* will be balanced, and the wheel again set in motion with the same velocity as before, and at the end of 1 minute both weights have descended 30 feet; then $30 \times 2 = 60$, the measure of the power expended; as in the other case, the friction being the only resisting force, 60 must also be the quantity of friction. In both cases the tension of the cord sustaining the body *b*, was the same, and had it been attached to a spring, would have bent it to the same degree. This seeming paradox may be explained by the annexed figures C, and D. Fig. C representing a water wheel transferring its power by the driving wheel *a*, to the pinion *b*, and through the shaft, fig. D, to the rollers 15 inches in diameter. The water wheel is 20 feet diameter, *a* is 10 feet, *b* 30 inches, and the shaft $7\frac{1}{2}$ inches diameter.

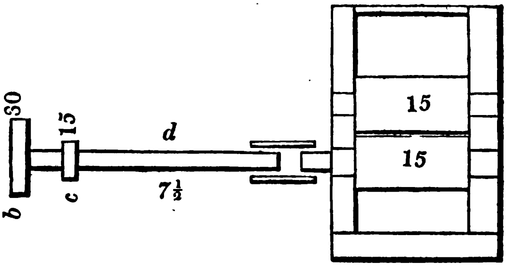
When the water is let on the wheel, the cogs of *a* press those of *b* with a force of 50, the torsion of the shaft, at its surface, will be 200, the surface of the bottom roller is urged forward with a force of 100, and a spring exerting a force of 100 in an opposite direction to the motion of the rollers would hold them in equilibrio.

Fig. C.



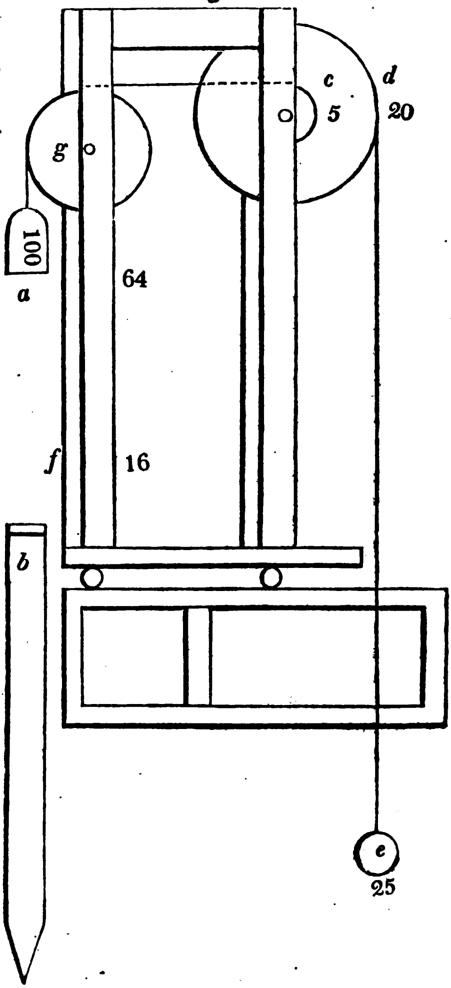
The pinion *c*, 15 inches diameter, is now geared with the wheel *a*, and double the former quantity of water applied to the water wheel; the cogs of *a* will now press those of *c* with a force of 100, the torsion of the shaft *d*, and the force of the surface of the rollers the same as before; and a spring exerting a force of 100, will hold the rolls in equilibrio. In this case double the water, and of course double the power, is expended by the water wheel moving with the same velocity, but the shaft *d* and rollers move with double their former velocity, by which means two bars of iron may be rolled in the time required to roll one in the former case, and that without subjecting the shaft or rollers to a greater degree of force. Thus the seeming paradox in the case of friction, appears in this but a simple operation, familiar to most practical mechanics. On this plain principle, the force of one man exerted on a crank connected with an iron shaft not more than one inch in diameter, can be made to twist off another shaft of one foot in diameter; I therefore conclude, that the theory which supposes friction to be as the space passed over, without regard to time, is true, and entirely free from any mysterious effects in its operation.

Fig. D.



I shall now endeavour to show that the forces or momentums of moving bodies are not simply as their velocities, but as the square of their velocities, by the simple Fig. E, representing a pile-driving machine. The frames being erected as shown in the figure; *a* is a body which weighs 100 lb. suspended by a cord passing over the pulley *g*, and wound round the pulley *c*, by the gravity of the body *e*, weighing 25 lbs. acting by the pulley *d*, which is attached to the axle of the pulley *c*. The pulley *d*, is 20 inches diameter, and *c*, 5 inches. The weight *e*, 25 lb. which balances, and has raised *a*, from the head of the pile 64 feet, in which operation *e* has descended 256 feet, multiplied by 25, gives 6400, which is the quantity of force transferred to *a*, and which, when disengaged from the cord, will be transferred by impact to the pile *b*, at which time the velocity of *a* will be 64 feet per second. *a* is again raised to the point *f*, 16 feet from the

Fig. D.



head of the pile, and there disengaged, and again it transfers its force to the pile as before; and at the instant of contact, the velocity of *a* was 32 feet per second, which is half the velocity of the first case. By raising *a* 16 feet, the weight *c* descends 64 feet, which, multiplied by 25, gives 600, the quantity of force transferred to the pile, that is, $\frac{1}{4}$ of the quantity transferred in the first fall of 64 feet, from which it appears that the power of *a* is as the square of its velocity. This machine is worthy of a careful and critical examination, by all who wish to obtain a true and correct understanding of this interesting subject, not only on account of the simple exemplification by it of the principles concerned, but chiefly for the important and well known effects which result from their application. If the powers are as the velocities, the mechanics who operate by these machines, have universally committed excessive errors, for they raise *a*, to as great a height as convenience will admit, thereby wasting unequal portions of the power employed to raise it; this waste increasing with the height, which waste would be avoided materially by doubling the weight *a* for every fourfold reduction of height; thus, if instead of the weight *a*, 100 lb. raised 64 feet, they had used *a*, 800 lb. raised one foot, they would have obtained the same effect, at an expense of no more than $\frac{1}{8}$ of the power; thus $800 \times 1 = 800$, the power expended to raise it 1 foot, and $100 \times 64 = 6400$, to raise 100 lb. 64 feet.

If the power of *a* equal 1600, was transferred to the pile when it was struck with a velocity 32 feet per second, and no more than double that power, viz. 3200 was transferred to the pile when it was struck

with a velocity 64 feet per second, and the power expended in *e*, transferred to *a* to produce the latter velocity, was 6400, it may be asked what became of the remaining power, that is, 3200, which must have been expended somewhere.

We should rather suspect the truth of the theory, than condemn as ignorant so great a number of men eminent for practical mechanical knowledge, obtained by extensive experience and observation, men who are undertakers and executors of heavy buildings, such as houses, stores, locks and bridges, on soft foundations, where it frequently occurs that the labour of driving the piles for the foundation is more than is expended in erecting the fabric thereon. I consider the laws which I have endeavoured to support more likely to be true than those which I oppose, because they lead to no extravagance or seeming absurdity in the details of application; and because they are supported by a variety of evidence evinced in practical operations, from which the adverse theories are excluded; to sustain some of which latter its adherents must maintain that the quantity of force necessary to move a mass of matter from this place to Pittsburg, on a level plane, will also be required to move the same matter across a table, provided each of them were the same length of time in performance; and further, that the quantity of resistance would not be increased by using runners sliding on the plane, instead of the best adjusted wheel and axle.

Philadelphia, August 10th, 1829.

NOTICES OF LITERARY AND SCIENTIFIC WORKS.

Virginia Literary Museum.—The prospectus of this Literary and Scientific journal, appeared in February last, and the first number was published on the 17th of June. Its objects are "to communicate the truths and discoveries of science to the miscellaneous reader, and to encourage a taste for polite literature."

Should it fail in attaining these ends, we may safely venture to predict that the fault will rest with the public alone, as the source from which it issues is a perennial one. The work is published at the University of Virginia, and under the auspices of its professors. Upon this simple fact its claims, in advance, may be securely rested.

It is not designed to confine this journal to "the erudite disquisitions of the scholar, or the profound researches of philosophy," but to comprehend whatever may please or instruct, admitting, therefore, the sportive effusions of wit and fancy, and thus to adapt the repast which is offered, to the diversified tastes of its readers.

In the plan and government of the University of Virginia, there is much to interest every friend of literature and science, as, in them, there is much of novelty; its founder, the venerated Jefferson, intending to establish an institution which should be adapted to the present state and wants of society. "The progress of an experiment of this high character, made by the most popular and most philosophical statesman of his age," will be recorded in this journal, and the lively curiosity respecting it, excited in the bosoms of the friends of learning, will consequently be satisfied.

The work is handsomely printed; a number issues every week, upon a sheet of super royal octavo. The terms are five dollars per annum, payable in advance; and communications, post paid, are to be addressed to the editors of the Virginia Literary Museum, University of Virginia.

The American Journal of Science and Arts.—It is now eleven years since Professor Silliman, of Yale College, commenced this journal, of which sixteen volumes have been published. At the time of its establishment, it was the only periodical of our country devoted to the natural and physical sciences, and during a large portion of the time which has elapsed since its commencement, it has stood alone; not only has it republished the discoveries made in Europe, but it has also been the vehicle of much original matter, and has thus largely contributed to diffuse both at home and abroad, a knowledge of the natural history, and the progress of general science and the arts in the United States.

The only compensation which the editor has obtained for his labours during this period, has been the approbation with which they have been received, and the conviction that he was largely contributing to the extension of useful knowledge; for whilst the merit of the work has been universally confessed, those who have supported it by their subscriptions have never exceeded six hundred, a number barely sufficient to defray the current expenses of such a work, whilst the conductor is compelled to forego many of the 'liberal things' which he devises.

Two years since an appeal was made to the public, urging the friends of science to use their efforts to extend the circulation of the Journal, by striving, individually, each to add one to the number of subscribers, and a similar appeal accompanies the number recently published. "*One thousand* subscribers are necessary to give the American Journal entire security, and to add, in the most desirable degree, to its efficiency, and to the excellence of its execution, *both in its material, and in its external dress.* Who can doubt that with proper exertions, FIVE HUNDRED ADDITIONAL SUBSCRIBERS MAY BE OBTAINED.

"The terms are three dollars a volume in advance, and there are two volumes a year, of two Nos. each; they were originally stipulated to contain 320 pages, but have averaged more than 400.

"The editor and his agents will pay to any person, one dollar for every new subscriber, who pays his advance for the year, or for one volume; and every new subscriber who volunteers his name either to the editor or his agents, with a payment in advance of five dollars, shall be credited six dollars in the first year's account.

"Returns may be made, either to the editor, or to Hezekiah Howe or A. H. Maltby, New Haven; E. Littell & brother, Philadelphia; G. & C. & H. Carvill, New York; Hilliard, Gray, Little & Wilkins, Boston, or to any of the agents of the Journal, who are authorized to fulfil the above stipulations. Complete sets of all the back volumes, can be furnished."

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

SEPTEMBER, 1829.

Remarks on the Stowage and Sailing of Ships and Vessels. By Commander John Pearse, R. N.

The following remarks have sprung from ideas formed during and after a practical experience, as a seaman, of upwards of twenty years' active sea service. I commit them to paper as a seaman; and solely with the intention of endeavouring to show, by a plain statement, what appear to me as errors in the system of stowing and sailing our ships. Perhaps I may venture to assert, that, generally speaking, there is no regular system followed, or that the subject is not sufficiently considered on mathematical principles.

Chapman, in the preface to his *Treatise on Ship Building*, observes, that, "in the construction of ships, people usually make attempts, at different times, to improve the form, each person according to his own experience; thus, after the construction of one ship, which has been tried and found to possess such or such a bad quality, it seems possible to remedy this defect in another. But it often (not to say generally,) happens, that the new ship possesses some fault equally as great, and, frequently, even that the former defect, instead of being removed, is increased. And we are unable to determine whether this fault proceeds from the form of the ship, or from other unknown circumstances.

It thus appears, that the construction of a ship with more or less good qualities, is a matter of chance, and not of previous design. And it hence follows, that as long as we are without a good theory on ship building, and have nothing to trust to beyond bare experi-

ments and trials, this art cannot be expected to acquire any greater perfection than it possesses at present.

"At the same time, the construction of ships and their equipment are attended with too great expense, not to endeavour, beforehand, to ensure their good qualities, and their suitableness for what they are intended for. The theory then which elucidates the causes of their different qualities, which determines whether the defects of a ship proceed from its form, or from other causes, is truly important; but as the theory is unlimited, practice must determine its limits. We may, consequently, further conclude, that the art of ship building can never be carried to the last degree of perfection, nor all possible good qualities be given to ships, before we at the same time possess, in the most perfect degree possible, a knowledge both of the theory and practice.

"Lastly, it is evident, from all that has been said, that a ship of the best form will not show its good qualities, except it is at the same time well rigged, well stowed, and well worked by those who command it."

I have quoted the authority of Chapman, to show that much depends on the stowage and management of a ship.

Many experiments have, of late years, been tried, many improvements made, and much, no doubt, yet remains to be done. But although naval architects appear still to differ respecting the formation of the body, it appears to me there is less room for improvement in the structure, than in the system of stowage and sailing, which appears to require considerable alteration, before it can reach perfection.

It has been very generally observed how well our own ships, after an action, and those captured from the enemy, have appeared to sail under jury-masts, or, comparatively speaking, they have appeared to sail better in proportion under jury-masts, than with their proper ones—a strong proof in support of which occurred a few years since.

The Essex, late American frigate, sailed from Plymouth, under very low jury-masts, attended by the Dwarf cutter, of two hundred and ten tons, for Dublin, there to remain as a depot. At the entrance of the Bristol Channel, they fell in with a large smuggling lugger, to which they gave chace off the wind; the Essex, after a considerable run, capturing the lugger, and leaving the Dwarf out of sight, or nearly so—a proof she must have sailed as fast as if properly masted.

I shall mention one more circumstance. It will be recollected, the Vanguard, lord Nelson's flag-ship, lost her fore-mast off Toulon, previous to his fleet joining him, and his pursuit of the French fleet to Egypt. His lordship proceeded in the Vanguard, under a jury fore-mast, to Egypt, back to Sicily, and to Egypt again, where he found the enemy; and I do not recollect the Vanguard causing the least delay or impediment to the fleet. Had his lordship considered it likely, or that the Vanguard would not have been able to keep her station in chase, in the event of falling in with the enemy at sea, he would, no doubt, have shifted his flag to some other ship; and the

world knows well his lordship was too anxious to be first in action to risk any thing that might disappoint him.

From these and similar circumstances, an opinion that many of our ships are overmasted, may have partly originated.

Ships are supposed to be constructed agreeable to plans mathematically arranged, varying in their formation according to the ideas of different architects, and intended to be immersed to a certain depth in the water, when complete and ready for sea. To which floatation, it appears to me, they should be brought to, and kept as near as possible, except there should be any material deviation in a ship from the plan about the load water-line; in that case it is better, and as a general thing it is as well, to observe the formation of the bottom about the load water-line; and be guided accordingly.

If a ship is built strictly agreeable to the plan, and is immersed deeper than the builder intends, his views are frustrated, and the object of constructing a ship adapted for fast sailing lost sight of.

Professor Inman, in his general remarks on the construction of ships of war, observes,—

"It may be observed, generally, that it is advantageous to give the projected ship the requisite stability with as little ballast as possible, by which means a constructor is enabled to reduce the displacement or magnitude of the body under water, a circumstance very favourable to a ship in sailing and working. With a similar view, every weight put on board, and reckoned in getting the displacement, should be kept as low as possible. No useless baggage or weight of any kind should be put on board on any account whatever."

I have quoted the above authority as bearing a little on the point, and in corroboration of what I allege.

I must also observe, that, by too deep an immersion, the fullest part of the body would be carried below the surface; consequently, the displacement would be considerably increased, and also the resistance of the water on the lower part of the bottom. It, therefore, appears to me, when a ship, immersed to a certain depth, has not sufficient stability under sail, that the masts should be reduced, in preference to immersing it deeper in the water.

That it is most natural a ship should have masts in proportion to the body, below the surface, when immersed to what is considered a proper depth, must appear very evident; and also that, with such masts, she would sail equally well, as with a deeper immersion and proportional addition to the masts. But it must be expected the ship would be more uneasy under the increased masts in bad weather; and as the masts and rigging may be considered as back sail on a wind, the increased masts and rigging must also add to the impediment of her sailing. Consequently, the advantage must evidently appear in favour of the lesser masts and immersion.

The case of the Essex must appear as strong proof in favour of the principle in sailing off the wind; being, no doubt, ballasted in proportion to her masts. At the same time, it must be allowed no just conclusion could have been derived from a trial of her on a

wind; as on that point, although the sail might be considered in fair proportion to the body immersed, yet, from the body floating high above the surface, the resistance of the wind on it would have been much greater than with a deeper immersion and masts in proportion. Neither would the immersion have been sufficient to resist the lateral impulse.

Chapman, in his *Treatise on Ship Building*, observes, that, "to determine the surface proper to be given to the sails, from the knowledge which we have of the effect of the wind on planes or sails, with different velocities in different directions, it would be necessary to enter upon long calculations of great difficulty, and yet of little importance. We may compare plans of ships, and of their rigging, which are tried and known, and nothing will be required further than to be guided by those ships which have the best proportion of canvass, with respect to the centre of effort of the wind on the sails and the stability."

And professor Inman, in his general remarks on the construction of ships of war, observes, that, "after all the pains the constructor may take, from the imperfection of the theory of resistances, or from some other unknown causes, it is possible that a ship, on going to sea, will not be found to have the point of sail exactly adjusted to the mean resistance. In this case, nothing can be done, except by altering the masting, for effecting which, if possible, every practical facility should, in the first place, be left in the building, or by bringing the ship more by the head or stern; thus adjusting the seat of the ship in the water to the masting, as it is."

By which it appears there is no rule which can be strictly depended on, to calculate a correct proportion for the masts or their positions.

Many of our ships of the same class and computed tonnage, differ in the formation of their bottoms; it also frequently happens that one ship shows greater stability under sail than another; and that, with the same quantity of provisions and stores, one is deeper immersed in the water than another. The only supposition to be drawn from it, is, that they have the same proportion of masts and ballast.

If the supposition be admitted, it appears to me very erroneous, and that ships, though of the same computed tonnage, differing in the formation of their bottoms, ought not, as an established rule, to have the same proportion of masts and ballast.

If one has less displacement than another, she will have less capacity in the hold; consequently, will not stow so much, or require so great a weight to immerse her so deep in the water. It, therefore, appears most natural she should have a less proportion of masts.

As well as what Chapman and professor Inman observe, respecting the proportions for, and positions of, the masts, it may be supposed, from the many alterations which have been made in the masts of our experimental ships, there is no rule to be depended on. And as Chapman observes, "we may compare plans of ships and of their rigging, &c.," which I have quoted before.

That such would be the most correct method to ascertain a true

proportion, there can be little doubt; but it appears to me no just conclusion can be made as to the proper proportion of masts, till the system of stowage has undergone considerable alterations.

I have ventured to assert that, generally speaking, there is no regular system followed in stowing our ships. In proof of which, I think it is only necessary to recollect the many alterations in the stowage of our experimental ships, and the various alterations in the trim of them at sea, and which appear to have made considerable alterations in their sailing qualities.

It is a very common practice to trim ships, by making each man carry a shot or two aft; removing the foremost guns aft, and which is frequently done to ease a ship in a head sea. But it should be recollected when a ship is in chase, the foremost guns are those generally first wanted, and require to be in their places, and the men frequently required in their stations. It must, therefore, appear evident, that but few of our ships are properly stowed; and that it is most essential an attempt should be made to improve the system, to obviate the necessity of such alterations at sea, by a better arrangement of the ballast, stores, and provisions.

I am of opinion that perfection in the stowage should be made a primary object; when that is attained, there will be a sure foundation to work from, in finding a true proportion for the masts. It appears to me perfectly easy, and I hope to see it reduced to a regular and perfect system.

I am also of opinion that, after viewing the formation of a vessel's bottom, very little consideration is required to determine how she ought to be stowed. Naval architects recommend the weight to be kept as near the centre as possible; to me the formation of the bottom points it out, and that the extremities should be kept as light as possible, to ease the pitching and sending motion in a head sea. That all has not been done to effect that object, and which appears to me easily may, I shall endeavour to explain.

Much cannot be said, and very little need be, as to the most proper place for stowing the ballast alone, or its arrangement: it is the distribution of the other weights which can most contribute to it; and the great weights, at present in the fore extremity, stand opposed to it.

A fact well worthy of notice may be introduced here:—

It is universally known how well the Kentish and Sussex smuggling vessels have always sailed. The fact is, there is very little but the cargo to stow, and that is placed in the centre of the vessel. A small quantity of provisions, a few sails, and their anchors and cables, is the only weight beside, and which is also kept clear of the extremities. And this method appears to be derived more from a sort of established knowledge or practice, which descends from father to son, than an acquired system, as perhaps there are no men possessed of less scientific knowledge.

I shall, therefore, only observe, with respect to the ballast, that it should be winged in proportion to the supposed or ascertained inclination of the ship to rolling, and on no account to extend it to the

finer parts; as without it, there is sufficient longitudinal space in a large ship to trim the ballast, so as to bring her to a proper draught of water, provided the stores and provisions are also properly arranged, and those of the least weight selected for stowing nearest the extremities. To contribute towards which, I propose removing the cat-heads, and stowing the anchors further aft; which may be effected, in my opinion, with little or no difficulty.

Viewing it on lever principle, the weight is now at the very extreme end, and the lever in the position "horizontal" of its greatest power.

Chapman observes, "the reason of the pitching and sending motion is easily seen. When a wave has passed the fore-part of the ship, and is got near the middle, there is a great void space under the bows, where the ship is not supported. It precipitates itself, therefore, with a certain momentum, which is the product of the weights in the fore-part, multiplied by their distance from the point where the ship is sufficiently supported.

"This kind of motion is greater in ships which are very full near the load-water-line, fore and aft, and very lean below; but if the weights in the fore-part are carried nearer the middle, the momentum with which the ship plunges itself in this part, will be less; and not only this motion becomes less quick, but, moreover, the following waves which meet the fore-part of the ship, have less difficulty in raising it again. The same observation may be made on the aft-part."

The preceding observations ought to be sufficient to convince all but the most prejudiced, that I am justified in what I propose; and naval architects must concur with me in its utility, although they have never put it in practice. I shall, therefore, endeavour to show that it is practicable.

By removing the cat-heads aft, there would be a few fathoms more of cat-fall to run up, but which, considering the very short time taken to cat the anchor, does not appear to me can be considered an objection: and the anchors being brought abaft the round of the bow, would fish clearer of the side than at present, and stow neater, and similar to the spare and sheet anchors.

From observations which I have made on several frigates, it appears to me, if the cat-heads were removed to the fore-part of the channels, which, in the several ships, would be from eight to ten feet further aft than where now placed, that both stock and fluke would stow perfectly clear of the ports. And when it is considered that a forty-six gun frigate's two bower anchors weigh four tons and a half, which, together with the stocks, cat-heads, knees, fastenings, &c., cannot be estimated at less than six or seven tons, there can be no doubt the removal aft of so much weight would give considerable relief to a ship in a head sea; contribute to a better arrangement in stowing the ship, and, in many cases, obviate the necessity of stowing ballast too near the after extremity. It would also be removing fifty per cent. more weight than the two foremost guns.

There are no vessels which require easing in a sea more than our

brigs. The weight of an eighteen gun brig's two bower anchors, stocks, cat-heads, knees, fastenings, &c., cannot be estimated at much less than four tons; and which, by a little alteration in the arrangement of the chain-plates, to admit the fluke of the anchor in between two shrouds, I am of opinion may be removed aft seven or eight feet, and the anchors stow clear of the ports: as the spare anchor stows clear, which is placed abaft the channels, I can see no reason why the bowers should not.

In cutters I have had the cat-heads so far aft, that the crown of the anchor has stowed close to the fore shroud; they have stowed perfectly easy, and I observed that the copper about the bows has been less injured, than in vessels which had their cat-heads further forward.

It is in our smaller and sharpest vessels its effect would be greatest, but there can be no doubt of its advantage in all ships; and should the experiment be tried, I have no doubt it will be extended to all.

In many ships, and all our smaller vessels, the coal-hole is also very far forward; and as the coals are a considerable weight, and not speedily consumed, I should recommend stowing them further aft, and water where they are now, and to use this water first.

There is also a very great weight in the fore extremity of a line-of-battle ship; the gunner's, boatswain's, and carpenter's stores, which it appears to me may be stowed nearer the centre of the ship, by the following arrangements.

Where those stores are now stowed, to build a room to receive part of the bread from aft, keeping a clear wing passage round the bows, by which means the bread would be as well preserved as if in the after bread-room. The bread forward can be used first, or it can be taken from forward and aft, alternately, as the trim of the ship may appear to require. The remaining space to be divided into store-rooms for marine clothing, slops, beds, and such light weights as are at present stowed in the after cock-pit.

All the mates, midshipmen, and assistant-surgeons, to mess in the gun-room, a much more healthy and airy situation than the cock-pit, and to have a store-room in the cock-pit for the mess-utensils and sea-stores.

By the removal of bread forward, the after bread-room may be considerably reduced, and the surgeon's and purser's cabins removed further aft. By such an arrangement there would be sufficient space abaft the cable-tiers for the reception of the gunner's, boatswain's, and carpenter's stores; and which would not be much abaft the centre of the ship.

In frigates, also, and smaller vessels, similar arrangements should be made as far as possible; and if those were carried into effect, there would be no necessity for extending the stowage of the ballast to the after extremity, as is too often the case.

In the Cruizer, "eighteen gun brig," we were obliged to stow ballast in the bread-room—the case, I believe, in most of the brigs; which would not have been requisite, had the anchors and coal-holes

been removed further aft. Since which, I believe, some alteration has been made in the store-rooms; but if weight has been reduced in the fore extremity, by that means, it has been increased again by the addition of a heavy forecastle, which also considerably increases the top weight. Poops and quarter boats have followed the forecastles; and to the little ten-gun brigs, all this additional top weight has been added—even a cutter of one hundred and twenty tons, follows the rage for carrying quarter boats.

I must repeat an observation of professor Inman's, as it is most applicable to the point in question:—

"It may be observed, generally, that it is advantageous to give the projected ship the requisite stability with as little ballast as possible, by which means a constructor is enabled to reduce the displacement or magnitude of the body under water, a circumstance very favourable to a ship in sailing and working. With a similar view, every weight put on board, and reckoned in getting the displacement, should be kept as low as possible. No useless baggage or weights of any kind should be put on board on any account whatever."

Every one who can agree with professor Inman, must condemn the system of adding so much top and overhanging weight.

Forecastles were first fitted by the captains, were very light, and could not have caused much impediment to the vessel's sailing; but the heavy way they are now fitted, many with heavy bulwarks above them, and other additions which have succeeded, must be materially felt.

I may be told the quarter boats are of a light description; but when every common sailor will admit a jacket hung in the rigging to be an impediment to sailing on a wind, I say it is inconsistent to carry quarter boats in such small vessels. But, allowing them to be of a light description, the weight of the iron davits is to be added, and it should be remembered that when a vessel is launching, although its actual weight is not, yet its power is, considerably increased by the action of the vessel.

I was four years and a half first lieutenant of an eighteen-gun brig; they were then in their original state, and no vessels sailed better. I afterwards commanded a large cutter four years, and had many opportunities of sailing with brigs, in their original state. Subsequent to which I commanded a large cutter three years, and under the orders of several of the finest brigs in their present state; and I am convinced they neither sail nor work so well as formerly, and that it is attributable to the alterations which have been made.

I am also of opinion, that by taking away the poops and quarter boats, building the forecastles as light as possible, with only a low wash-stroke of three-quarter inch elm or oak board above it, which would be quite sufficient, and removing the anchor and coal-holes further aft, they would be superior in their sailing qualities, and as sea boats, to what they were in their original state.

Masts are frequently raked, by some to ease a ship in a head sea, by others to improve her sailing.

It does not, however, occur to me, that it can give much relief to a ship: for, supposing it to be the overhanging weight of the mast, acting on lever principle, which contributes to the pitching motion, the mast must be considerably beyond a perpendicular before it can have much effect; and admitting the supposition, it may naturally be supposed that a raking mast will act diametrically, and increase the sending motion aft.

But there appears to me a great objection to raking masts, in ships and square-rigged vessels.

If masts are raked, the yards are not at right angles with them, when a ship is on a wind. The consequence is, the sails are put out of their proper form, and drawn, or I may say forced, towards a diamond shape. The main-sail shows it in the diagonal girt across the sail from the tack to the lee-earing; the leeches of the sails are quite slack, and bag to leeward.

It is allowed the wind acts on the same principle when striking the sails obliquely, as if perpendicular, or at right angles—its power decreasing as the obliquity increases. If, therefore, the lee leeches of sails are slack, and bag to leeward, the obliquity of the wind must be increased, and its power lessened. It, therefore, appears much preferable to give a ship relief, by removing weight from the fore extremity, than by raking the masts.

I have frequently heard of various alterations having been tried in ships, to improve their sailing, and that raking the masts was the only one which proved successful. This is a circumstance which, it appears to me, may be considered as arising from some of those unknown causes alluded to by professor Inman in the following observation:—

"After all the pains the constructor may take, from the imperfection of the theory of resistances, or from some other unknown causes, it is possible that a ship, on going to sea, will not be found to have the point of sail exactly adjusted to the mean resistance. In this case, nothing can be done except by altering the masting; for effecting which, if possible, every practical facility should, in the first place, be left in the building, or by bringing the ship more by the head or stern, thus adjusting the seat of the ship in the water to the masting as it is."

The circumstance, however, proves an error; but where, it is difficult to determine,—and without being in possession of particulars, it were useless to attempt it. The ships might not have had their proper seats in the water; the point of sail might not be correctly adjusted, or it might arise from some other cause.

It is evident, however, that, seated in the water as they were, they required more after-sail—consequently could not have steered well; and it generally happens when a ship steers badly she does not sail well. The conclusion, therefore, may very naturally be, that raking the masts improved both steering and sailing qualities.

It, however, appears to me, when a ship is properly seated in the water, and requires more after-sail, that it is preferable to remove the foremast a little further aft than to rake the masts, as it would

have the same effect, and give considerable relief to the fore extremity.

There is one part of professor Inman's observation—"or by bringing the ship more by the head or stern, thus adjusting the seat of the ship in the water to the masting, as it is," which it appears to me can only be meant as a temporary expedient, and till an opportunity offers to alter the masting; as it would be sacrificing a very material point—the proper seat of the ship in the water. J. P.

[*Quarterly Journal.*

On the Phenomena of Volcanoes. By Sir HUMPHRY DAVY, Bart. F.R.S.*

WHEN in the years 1807 and 1808, I discovered that the alkalies and the earths were composed of inflammable matter united to oxygen, a number of inquiries suggested themselves with respect to various parts of chemical science, some of which were capable of being immediately assisted by experiment, and others required for their solution a long series of observations, and circumstances obtained only with difficulty. Of the last kind were the inferences concerning the geological appearances connected with these discoveries.

The metals of the alkalies, and those of such of the earths as I had decomposed, were found to be highly combustible, and altered by air and water even at the usual temperatures of the atmosphere; it was not possible, consequently, that they should be found at the surface of the globe, but probable that they might exist in the interior: and allowing this hypothesis, it became easy to account for volcanic fires, by exposure of the metals of earths and alkalies to air and water; and to explain, not only the formation of lavas, but likewise that of basalts and many other crystalline rocks, from the slow cooling of the products of combustion or oxidation of the newly-discovered substances.

I developed this opinion in a paper on the decomposition of the earths, published in 1808; and since 1812, I have endeavoured to gain evidence respecting it by examining volcanic phenomena of ancient and recent occurrence in various parts of Europe.

In this communication I shall have the honour of laying before the Royal Society some results of my inquiries. If they do not solve the problem respecting the cause of volcanic fires, they will, I trust, be found to offer some elucidations of the subject, and may serve as the foundation of future labours.

The active volcano on which I have made my observations is Vesuvius; and there probably does not exist another so admirably fitted for the purpose: its vicinity to a great city; the facility with which it may be ascended in every season of the year; and the nature of

* From the Philosophical Transactions, for 1828. Part 1.

its activity,—all offer peculiar advantages to the philosophic inquirer.

I had made several observations on Vesuvius in the springs of 1814 and 1815, which I shall refer to on a future occasion in these pages; but it was in December, 1819, and January and February, 1820, that the volcano offered the most favourable opportunity for investigation. On my arrival at Naples, December 4, I found that there had been a small eruption a few days before, and that a stream of lava was flowing with considerable activity from an aperture in the mountain a little below the crater. On the 5th I ascended the mountain, and examined the crater and the stream of lava. The crater emitted so large a quantity of smoke, with muriatic and sulphurous acid fumes, that it was impossible to approach it except in the direction of the wind; and it threw up every two or three minutes showers of red hot stones. The lava was flowing from an aperture about one hundred yards below it, being apparently forced out by elastic fluids, with a noise like that made by the steam disengaged from a pressure engine; it rose, perfectly fluid, forming a stream of from five to six feet in diameter, and immediately fell, as a cataract, into a chasm about forty feet below, where it was lost under a kind of bridge formed of cooled lava; but it re-appeared sixty or seventy yards further down. Where it issued from the mountain, it was nearly white hot, and exhibited an appearance similar to that which is shown when a pole of wood is introduced into the melted copper of a foundry, its surface appearing in violent agitation, large bubbles rising, which in bursting produced a white smoke; but the lava became of a red colour, though still visible in the sunshine, where it issued from under the bridge. The force with which it flowed was so great, that the strength of the guide, a very stout young man, was insufficient to keep a long iron rod in the current. The whole of its course, with two or three interruptions, where it flowed under a cooled surface, was nearly three-quarters of a mile, and it threw off clouds of a white smoke. It smoked less as it cooled and became pasty; but even where it terminated in moving masses of scoria, smoke was still visible, which became more distinct whenever the scoria was moved, or the red hot lava in the interior exposed.

Having ascertained that it was possible to approach within four or five feet of the lava, and to examine the vapour immediately close to the aperture, I returned the next day, having provided the means of making a number of experiments on the nature of the lava, and of the elastic fluids with which it was accompanied. I found the aperture nearly in the same state as the day before, but the lava spread over a larger surface, forming an eddy in the hollow of the rock, over which it fell, from which it could be raised in an iron ladle more easily than from the current, and where there was much more facility of placing and withdrawing substances intended to be exposed to its agency.

One of the most important points to be ascertained, was, whether any combustion was going on at the moment the lava issued from the mountain. There was certainly no appearance of more vivid igni-

tion when it was exposed to air, nor did it glow with more intensity when it was raised into the air by an iron ladle. I put the circumstance, however, beyond the possibility of doubt: I threw some of the fused lava into a glass bottle furnished with a ground stopper, containing siliceous sand in the bottom: I closed it at the moment, and examined the air on my return. A measure of it mixed with a measure of nitrous gas gave exactly the same degree of diminution as a measure of common air which had been collected in another bottle on the mountain.

I threw upon the surface of the lava, nitre, both in mass and in powder. After this salt had fused, there was a little increase of vividness in the ignition of the lava, but much too slight to be referred to pure combustible matter in any quantity; and on making the experiment on a portion of lava taken up in the ladle, it appeared that the disengagement of heat was partly owing to the peroxidation of the protoxide of iron, and to the combination of the alkali of the nitre with the earthy basis of the lava; for where the nitre had melted, the colour had changed from olive to brown. This conclusion was still further proved by the circumstance, that chlorate of potash thrown upon the lava did not increase its degree of ignition so much as nitre. When a stick of wood was introduced into a portion of the lava, so as to leave a little carbonaceous matter on its surface, nitre or chlorate of potassa then thrown upon it caused it to glow with great brilliancy. Some fused lava was thrown into water, and a glass bottle filled with water held over it to collect the gas disengaged; it was in very minute quantity only, and when analyzed on my return proved to be common air, a little less pure than that disengaged from the water by boiling. A wire of copper of $\frac{1}{20}$th of an inch in diameter, and a wire of silver of $\frac{1}{50}$th, introduced into the lava near its source, were instantly fused: an iron rod of $\frac{1}{8}$th of an inch, with a piece of iron wire of about $\frac{1}{30}$th, were kept for five minutes in the eddy in the stream of lava; they were not fused; they did not produce any smell of sulphuretted hydrogen when acted on by muriatic acid. A tin-plate funnel filled with cold water was held in the fumes disengaged with so much violence from the aperture through which the lava issued: fluid was immediately condensed upon it, which was of an acid and subastringent taste. It did not precipitate muriate of baryta; but copiously precipitated nitrate of silver, and rendered the triple prussiate of potassa of a bright blue. When the same funnel was held in the white fumes above the lava where it entered the bridge, no fluid was precipitated upon it, but it became coated with a white powder which had the taste and chemical qualities of common salt, and proved to be this substance absosolutely pure. A bottle of water holding about $\frac{3}{4}$ of a pint, with a long narrow neck, was emptied immediately in the aperture from which the vapours pressing out the lava issued, and the neck was immediately closed. This air examined on my return was found to give no absorption with solution of potassa; so that it contained no notable proportion of carbonic acid, and it consisted of 9 parts of oxygen and 91 of azote. There was not the least smell of sulphur-

ous acid in the vapour from the aperture, nor were the fumes of muriatic acid so strong as to be unpleasant; but during the last quarter of an hour that I was engaged in these experiments, the wind changed, and blew the smoke from the crater upon the spot where I was standing: the sulphurous acid gas in the fumes was highly irritating to the organs of respiration, and I suffered so much from the exposure to them that I was obliged to descend; and the effect was not transient, for a violent catarrhal affection ensued, which prevented me for a month from again ascending the mountain.

On the 6th of January I made another visit to Vesuvius. I found the appearance of the lava considerably changed; the bocca from which it issued on the 5th of December was closed, and the current now flowed quietly and without noise from a chasm in the cooled lava about three hundred feet lower down. The heat was evidently less intense. I repeated my experiments with nitre with the same results, and exposed pure silver and platinum to the fused lava: they were not at all changed in colour. I collected the sublimations from various parts of the cooled lava above. The rocks near the ancient bocca were entirely covered with white, yellow, and reddish saline substances. I found one specimen of large saline crystals in a cavity, which had a slight tint of purple: this examined, proved to be common salt with a minute portion of muriate of cobalt. The other sublimations consisted of common salt in great excess, much chloride of iron, some sulphate of soda; and by the test of muriate of platinum, there appeared to exist in them a small quantity of sulphate or muriate of potassa; and a solution of ammonia detected the presence of a minute quantity of the oxide of copper.

During the months of January and February I made several visits to the top of Vesuvius: I shall not particularize them all; but shall mention only such as afforded me some new observations. On the 26th of January, the lava was seen nearly white hot through a chasm near the place where it flowed from the mountain. I threw nitre upon it in large quantities through this chasm, in the presence of H. R. H. the Prince of Denmark, whom I had the honour of accompanying in this excursion to the mountain, and my friend the Cavaliere Monticelli: there was no more increase of ignition than when the experiment was made on lava exposed to the free air. The appearance of the sublimations was now considerably changed: those near the aperture were coloured green and blue by salts of copper; but there was still a great quantity of muriate of iron. I have mentioned, that on the 5th the sublimate of the lava was pure chloride of sodium: in the sublimate of January 6th, there were both sulphate of soda and indications of sulphate of potassa. In the sublimates that I collected on the 26th, the sulphate of soda was in much larger quantities, and there was much more of a salt of potassa. From the 5th of December to the 20th of February, the lava flowed in larger or smaller quantities, so that at night a stream of ignited matter was always visible, more or less interrupted by cooled lava. It changed its direction according to the obstacles it met with; and never, according to appearances, extended so much as a mile from its source.

During the whole of this time the craters, of which there were two, were in activity. The large crater threw up showers of ignited ashes and stones to a height apparently of from 200 to 500 feet; and from a smaller crater, to the right of the large one on the side of Naples, steam arose with great violence. Whenever the crater could be approached, it was found incrusted with saline incrustations; and the walk to the edge of the small crater on the 6th of January was through a mass of loose saline matter, principally common salt coloured by muriate of iron, in which the foot sunk to some depth. It was easy, even at a great distance, to distinguish between the steam disengaged by one of the craters, and the earthy matter thrown up by the other. The steam appeared white in the day, and formed perfectly white clouds, which reflected the morning and evening light of the purest tints of red and orange. The earthy matter always appeared as a black smoke, forming black clouds; and in the night it was highly luminous at the moment of the explosion.

On the 20th of February, the small crater which had been disengaging steam and elastic matter, began to throw out showers of stones; and both craters, from the 20th to the 23d, were more than usually active. On the night of the 23d, at half past 11 o'clock, being in my bed-room at Chiatimone, Naples, I heard the windows shake; and going to the window, I saw ascending from Vesuvius a column of ignited matter to a height at least equal to that of the mountain from its base; and the whole horizon was illuminated, notwithstanding the brightness of the moon, with direct volcanic light, and that reflected from the clouds above the column of ignited matter. Several eruptions of the same kind, but upon a smaller scale, followed at intervals of a minute and a half or two minutes; but there were no more symptoms of earthquake, nor did I hear any noise. On observing the lava, it appeared at its origin much broader and more vivid; and it was evident that a fresh stream had broken out to the right of the former one. On the morning of the 24th I visited the mountain; it was not possible to ascend to the top, which was covered with clouds, nor to examine the orifice from which the lava issued. The stream of lava near the place where it terminated was from 50 to 100 feet broad. It had precisely the same appearances as the lava which had been so long running. I collected the saline matter condensed upon some of the masses of scoria which were carried along by the current and deposited on the edge of the stream; they proved to be the same in the nature of their constituent parts as those of the lava of the 26th of January, but with a larger proportion of sulphate of soda, and a smaller proportion of muriate of iron; and I have no doubt that the dense white smoke which was emitted in immense columns by the lava during the whole of its course, was produced by the same substances.

I shall now mention the state of the volcano at some other periods.

When I was at Naples in May, 1814, the crater had the appearance of an immense funnel, closed at the bottom, with many small apertures emitting steam; and on the side towards Torre del Greco,

there was a large aperture, from which flame issued to a height of at least 60 yards, producing a most violent hissing noise. This phenomenon was constant during the three weeks I remained at Naples. It was impossible to approach sufficiently near the flame to ascertain the results of the combustion; but a considerable quantity of steam ascended from it. When the wind blew the vapours upon us, there was a distinct smell both of sulphurous and muriatic acids. There was no indication of carbonaceous matter from the colour of the smoke; nor was any deposited upon the yellow and white saline matter which surrounded the crater, and which I found to be principally sulphate and muriate of soda, and muriate of iron: in some specimens there was a considerable quantity of muriate of ammonia.

In March, 1815, the appearances presented by the crater were entirely different. There was no aperture in the crater; it was often quiet for minutes together, and then burst out into explosions with considerable violence, sending fluid lava and ignited stones and ashes to a considerable height, many hundred feet in the air.

These eruptions were preceded by subterraneous thunder, which appeared to come from a great distance, and which sometimes lasted for a minute. During the four times that I was upon the crater in the month of March, I had at last learnt to estimate the violence of the eruption from the nature of the sound: loud and long continued subterraneous thunder indicated a considerable explosion. Before the eruption the crater appeared perfectly tranquil; and the bottom, apparently without an aperture, was covered with ashes. Soon, indistinct rumbling sounds were heard, as if at a great distance; gradually the sound approached nearer, and was like the noise of artillery fired under our feet. The ashes then began to rise and to be thrown out with smoke from the bottom of the crater; and lastly, the lava and ignited matter was ejected with a most violent explosion. I need not say, that when I was standing on the edge of the crater witnessing this phenomenon, the wind was blowing strongly from me: without this circumstance, it would have been dangerous to have stood on the edge of the crater; and whenever from the loudness of the thunder the eruption promised to be violent, I always ran as far as possible from the seat of danger.

As soon as the eruption had taken place, the ashes and stones which rolled down the crater seemed to fill up the aperture, so that it appeared as if the ignited and elastic matter were discharged laterally; and the interior of the crater assumed the same appearance as before.

I shall now offer some observations on the theory of these phenomena. It appears almost demonstrable that none of the chemical causes anciently assigned for volcanic fires can be true. Amongst these, the combustion of mineral coal is one of the most current; but it seems wholly inadequate to account for the phenomena. However large a stratum of pit-coal, its combustion under the surface could never produce violent and extensive heat; for the production of carbonic acid gas, when there was no free circulation of air, must tend constantly to impede the process: and it is scarcely possible

that carbonaceous matter, if such a cause existed, should not be found in the lava, and be disengaged with the saline or aqueous products from the bocca or craters. There are many instances in England of strata of mineral coal which have been long burning; but the results have been merely baked clay and schists, and it has produced no result similar to lava.

If the idea of Lemery were correct, that the action of sulphur on iron may be a cause of volcanic fires, sulphate of iron ought to be the great product of the volcano; which is known not to be the case; and the heat produced by the action of sulphur on the common metals, is quite inadequate to account for the appearances. When it is considered that volcanic fires occur and intermit with all the phenomena that indicate intense chemical action, it seems not unreasonable to refer them to chemical cause. But for phenomena upon such a scale, an immense mass of matter must be in activity, and the products of the volcano ought to give an idea of the nature of the substances primarily active. Now what are these products? Mixtures of the earths in an oxidated and fused state, and intensely ignited; water and saline substances, such as might be furnished by the sea and air, altered in such a manner as might be expected from the formation of fixed oxidated matter. But it may be said, if the oxidation of the metals of the earths be the cause of the phenomena, some of these substances ought occasionally to be found in the lava, or the combustion ought to be increased at the moment the materials passed into the atmosphere. But the reply to this objection is, that it is evident that the changes which occasion volcanic fires, take place in immense subterranean cavities; and that the access of air to the acting substances occurs long before they reach the exterior surface.

There is no question but that the ground under the solfaterra is hollow, and there is scarcely any reason to doubt of a subterraneous communication between this crater and that of Vesuvius: whenever Vesuvius is in an active state, the solfaterra is comparatively tranquil. I examined the bocca of the solfaterra on the 21st of February, 1820, two days before the activity of Vesuvius was at its height: the columns of steam which usually arise in large quantities when Vesuvius is tranquil, were now scarcely visible, and a piece of paper thrown into the aperture did not rise again; so that there was every reason to suppose the existence of a descending current of air.* The subterraneous thunder heard at such great distances under Vesuvius, is almost a demonstration of the existence of great cavities below filled with aëriform matter: and the same excavations which in the active state of the volcano throw out during so great a length of time immense volumes of steam, must, there is every reason to believe, in its quiet state become filled with atmospheric air.†

* In 1814, in 1815, and in January, 1819, when Vesuvius was comparatively tranquil, I observed the solfaterra in a very active state, throwing up large quantities of steam and some sulphuretted hydrogen.

† Vesuvius is a mountain admirably fitted, from its form and situation, for experiments on the effect of its attraction on the pendulum: and it would be

To what extent subterraneous cavities may exist even in common rocks, is shown in the limestone caverns of Carniola, some of which contain many hundred thousand cubical feet of air; and in proportion as the depth of an excavation is greater, so is the air more fit for combustion.

The same circumstance which would give alloys of the metals of the earths the power of producing volcanic phenomena, namely, their extreme facility of oxidation, must likewise prevent them from ever being found in a pure combustible state in the products of volcanic eruptions; for before they reach the external surface, they must not only be exposed to the air in the subterranean cavities, but be propelled by steam; which must possess, under the circumstances, at least the same facility of oxidating them as air. Assuming the hypothesis of the existence of such alloys of the metals of the earths as may burn into lava in the interior, the whole phenomena may be easily explained from the action of the water of the sea and air on those metals; nor is there any fact or any of the circumstances which I have mentioned in the preceding part of this paper, which cannot be easily explained according to that hypothesis. For almost all the volcanoes in the old world of considerable magnitude are near, or at no considerable distance from the sea: and if it be assumed that the first eruptions are produced by the action of sea water upon the metals of the earths, and that considerable cavities are left by the oxidated metals thrown out as lava, the results of their action are such as might be anticipated; for after the first eruptions, the oxidations which produce the subsequent ones may take place in the caverns below the surface; and when the sea is distant, as in the volcanoes of South America, they may be supplied with water from great subterranean lakes; as Humboldt states that some of them throw up quantities of fish.

On the hypothesis of a chemical cause for volcanic fires, and reasoning from known facts, there appears to me no other adequate source than the oxidation of the metals which form the bases of the earths and alkalies; but it must not be denied that considerations derived from thermometrical experiments on the temperature of mines and of sources of hot water, render it probable that the interior of the globe possesses a very high temperature: and the hypothesis of the nucleus of the globe being composed of fluid matter, offers a still more simple solution of the phenomena of volcanic fires than that which has been just developed.

Whatever opinion may be ultimately formed or adopted on this subject, I hope that these inquiries on the actual products of a volcano in eruption will not be without interest for the Royal Society.

easy in this way to determine the problem of its cavities. On Etna, the problem might be solved on a larger scale.

On the Advantages of Machines.

(From Marratt's Mechanical Philosophy.)

PERSONS unskilled in the nature and power of machines, generally form false notions concerning them; this frequently produces egregious errors, and mischievous speculations. One of the most common conceits of these blunderers, is that of considering this power as capable of being made to increase, and thus multiplying their effects as agents, which is not always true. To form a just notion of the aid which may be expected from machines, looking to the uses to which they are commonly put, we shall divide them into two kinds; namely, 1st. Those which are intended simply to sustain a weight; and, 2nd. Those which are intended to draw it, or to raise it equably.

In machines of the first sort, both the effect of the machine, and the immediate effect of the power, can only be estimated by the weight sustained. This being understood, it is evident that the machine increases the effect of the power; thus a force of 10 pounds, by means of a lever, will sustain 100 lbs., provided the arm belonging to the power be 10 times as long as that belonging to the weight.

If it be asked how the power can ever produce an effect so much greater than itself, the answer, after a little consideration, will be this; the power of 10 pounds *does not*, in reality, sustain the weight of 100 pounds, but only a tenth part of it. For let the lever be one of the second kind; the weight 100 may be resolved into two, the one of which will be 90, and the other 10; the one equal to 90 is supported by the fulcrum, and the power of 10 only sustains the other part of the weight, which is 10 also. *Archimedes* required only a fixed point, to hold the whole globe of the earth in equilibrium. If he had found it, says CARNOT, it would not, in fact, have been *Archimedes*, but the fixed point, which would have sustained the earth.

In machines of the second kind, neither the effect of the machine, nor that of the power, can be estimated simply by the weight raised; for, otherwise, the measure of the effect would be altogether vague and indeterminate. In fact, any force, however small, may move a weight, however great, if it only be granted that the weight admits of being divided, and of being carried by one piece at a time. It is necessary then to take notice also of the *time* in which the power can move the weight from one place to another; or to ascertain the velocity with which the body is moved; and on this account it is, that the effect is measured by the weight multiplied by the velocity.

On this principle, we have already shown that the machine does not increase the effect of the force. If a man, acting with a force of 10 pounds, can raise, by means of a machine, a weight of 100 pounds, he must move with a velocity ten times as great as the weight; and, therefore, he does just as much as if, operating without a machine, he carried these 100 pounds at 10 journeys, loading himself with 10 pounds at a time. Hence it is exceedingly plain, that,

what is gained in this way by moving the weight, is lost in velocity, and the effect remains the same.

With respect then to the two kinds of machines above described, there is this characteristic difference; namely, that the first sort add to the effect of the power, while the second do not add to it. There is another difference not less remarkable respecting the resistances of friction, of ropes, and other resistances. In machines of the *first* kind, these resistances are all in favour of the power, and sustain, themselves, a portion of the weight; whence there remains so much less for the power to support. On the contrary, in machines of the *second* kind, the resistances are all of them detrimental to the power, and form part of the weight to be overcome; whence, on this account, a force is required greater than what would be required if there were no resistance.

We can now easily bring into view the true scope and real utility of machines. Machines of the *first* kind, seem to increase the effect of the power; and they do this by distributing the weight conveniently between the power and the prop. Machines of the *second* kind serve not to augment the effect of the power in quantity, but to modify its quality in the manner in which it is wanted; and they do this in the following manner. The effect of the machine being the product of the weight and velocity, we can increase at pleasure *one* of the two factors, provided that the other be proportionably diminished. Thus, by means of a machine, we can move a weight enormously great, provided that we have plenty of time, or are content to do it slowly; or, on the contrary, we can move a weight with a very great velocity provided that this weight be small: indeed, by the immediate application of the power, we can scarcely go beyond certain limits either of velocity or weight.

Another use of machines is that of enabling us to apply to the moving or sustaining of weights those forces which are not immediately suitable to such a purpose, and with that particular direction which is most advantageous for the power. Thus, the impact of a stream of water, or the force of a horse, could not be applied to draw water from a well, or stones from a quarry, unless by the intervention of a suitable machine; and man himself draws water more easily by means of a pulley, than he otherwise could do by pulling the bucket perpendicularly upwards.

It is impossible to lay down rules by which all machines may be disposed in the most advantageous manner; the following hints however will be of service.

First. In machines intended for carrying weights, it is best to reduce the friction, and the other resistances, to the least quantity possible; but not those intended simply to support weights. Therefore, generally speaking, in the first case, *simple* machines are preferable; in the second, *compound* machines.

Second. When the force decreases as the velocity increases, it is best to dispose the machine so that the force of each agent may be exerted to the greatest advantage, which may be done as has been before explained.

Third. In general, it is proper to take care that the whole of the force be employed to the greatest advantage in producing the intended effect; and also that no part of it be wasted on effects foreign to the intended purpose of the machine. Thus, in the lever, if the power act obliquely to its arm, a part of the power will be lost in pressing it against the point of support, with a useless consumption of force to the mere detriment of the machine.

Fourth. When a weight is raised by means of a crank, the mean arm of the lever may be considered as constant, and equal to $\frac{7}{11}$ of the breadth of the crank. Combinations of two, three, or four cranks, variously disposed on the same axle, are sometimes made use of. When four are disposed at right angles to each other, very little power is lost. The single crank is of great use in practical mechanics, and its power is as given above. The investigation is too difficult to be here inserted; it may be made out however in the manner given in Fenwick's Essays; and a complete demonstration is given in Venturoli's Mechanics.

Fifth. Simplicity in the construction of machines cannot be too strongly recommended; for a multiplicity of parts, or a variety of motions, increases the expense of erection, augments the friction, and increases the danger of breaking. To reduce a complex machine to a simple one, we must construct the various parts of the simple machine so that the velocity of the impelled point may be to that of the working point in the same ratio as in the complex machine; then the efforts of these two machines are the same in *theory*, but in practice the simpler will be much less subject to friction and accidents.

Notice of a "Treatise on Heat, and its Application in Arts and Manufactures. By E. Peclet." *2 vols. with plates. Paris,* 1828.

[From the Foreign Quarterly Review, published in London.]

Whatever consequences may have resulted to France from the memorable occurrences of which she was the theatre at the close of the last century, the national industry received an irresistible impulse, which has carried her forward, ever since, in the career of improvement. The coalition which deprived our Gallic neighbours of all external resources, threw them back upon their own. The effect was magical; arts and manufactures sprang at once into no feeble and infantine existence, but like Minerva from Jupiter's brain. This may be attributed, in great measure, to the subversion of one among many other usages inseparable from antiquated forms of government—the selection of persons from every other cause than merit, to fill responsible and arduous situations. Necessity reversed this procedure in France; talent was cultivated, ability put in universal requisition, and science judiciously employing what were, apparently, the most unpromising materials, almost instantaneously rendered the nation independent. Never did philosophy hold so exalted a rank as when she thus answered the call of patriotism. From

that moment to the present, works have been issuing from the Gallic Press, which developed new principles in every department of science, and directed the application of them, or suggested new processes to modify and improve such as were already known. M. Péclet's treatise belongs to the latter class. The first volume details, 1. the physical theory of heat; 2. the theory of combustion and combustibles; 3. the theory of the movements of heated air; 4. the theory of chimneys. The second volume contains the application of the above—1. vaporization; 2. distillation; 3. evaporation; 4. drying; 5. heating of elastic fluid; 6. heating of liquids; 7. heating of solid bodies; 8. cooling. The author has made very many and ingenious experiments, the results of which prove that an alteration, which we shall hereafter notice, is required in the numerical values of certain terms in the formulæ hitherto employed. There are, besides, many interesting particulars in the book, as will appear in the course of the present article. But the writings of Tredgold and others of our distinguished engineers, have been, of necessity, so incorporated in the work, that, to an English reader, there is nothing new beyond what we shall extract. The total suppression of Dr. Black's name, while his theory is adopted, we regard as a compliment, implying, as it does, his merits to be so generally known, that any notice of his labours must be superfluous. We speak this with sincerity; the candour with which M. Péclet acknowledges the various sources of his information, is so rare among his countrymen, that we point out this instance of it with peculiar pleasure. The following is an ingenious application of a well known fact:—

"The force with which solid bodies tend to change their volume by the variations of temperature, is very considerable. Mr. Molard, former director of the Museum of the Arts, applied it with success. The two side walls of one of the halls of the Museum, had bulged outwards, from the pressure of the vault they supported. To bring them back, Mr. M. pierced the walls with iron bars terminated externally with strong nuts; by screwing up these, the walls could be prevented from a greater divergence, but it was not possible to bring them back to their original position. One half of the bars was then heated by means of lamps placed beneath them; these were consequently lengthened, the screws could be tightened, and the walls were partially brought back. By repeating the operation, the total restoration of the walls was effected."

Admitting, as we do, the theoretical correctness of Saussure's hygrometer, we were much astonished at the author's high opinion of its practical utility; Despretz having shown from numerous and direct observations, that not the least reliance can be placed on its indications. The blind acquiescence, likewise, with which Sir H. Davy's explanation of the theory of his safety lamp is received, seems unaccountable, a more satisfactory hypothesis having been given by an Italian philosopher, M. G. Libri, of Florence, who ascribes its effect to the repulsive force of the metallic wire forming the gauze, not allowing the flame to pass through its interstices. The relative quantity of radiant heat which alone is applicable to domestic par-

poses, from different combustibles, has been variously stated, some authors estimating it at only a few hundredths of the total heat disengaged; the subject received M. Péclet's especial attention; the apparatus he employed it is needless to describe; the results are as follow:—With wood, the quantity of heat dispersed by radiation, is to the total heat developed : : 1 : 3.74. The quantity of radiant heat is to that carried off by the chimney : : 1 : 3. With charcoal, these proportions are respectively 1 : 2.36 and 1.236 : 1. With coal, these quantities were not determined, from the difficulty attending the experiments; it is, however, conjectured by the author, that the power of radiation is superior to that of charcoal, and that with coke it is very much more so. With peat, and the charcoal from it, the approximate ratios are 1 : 2.6 and 1 : 1.6. From the superiority of the apparatus employed, and the care bestowed on the investigation, these results may be received with confidence. Of the formulæ hitherto, with but few exceptions, universally adopted for ascertaining the velocity of heated air, it is remarked that they are not at all exact; they assign

"For the height of the column which generates the velocity, the difference between the column of cold external air, and that of the column of warm air reduced to the density of the external air; but the velocity thus obtained is that which cold air, subjected to the same pressure, would have, and not that of the warm air. The difference may be considerable, for in the example we have selected, the velocity of the warm air is in value 19.18, while calculated according to the preceding principle, it would be only 16.33 metres."

If then h represent the height of the column of heated air, t the external, and t' the internal temperature, m the dilatation of air for each degree of the centigrade thermometer, the height of the column of cold air reduced to 0° is $h\left(\frac{1}{1 + t\,m}\right)$ and at the temperature t' is $h\left(\frac{1}{1 + t\,m}\right)(1 + t'\,m)$ consequently the height of the column which generates the velocity, is $h\left(\frac{1 + t'\,m}{1 + t\,m} - 1\right)$ and v, the velocity given by the formula, $= \sqrt{2\,g\,h\left(\frac{1 + t'\,m}{1 + t\,m} - 1\right)}$ whereas v, as assigned by Tredgold and others $= \sqrt{2\,g\,h\left(1 - \frac{1 + t\,m}{1 + t'\,m}\right)}$ which values, differing only in the last factors, will be to each other as these factors : : $\sqrt{\frac{1}{1 + t\,m}} : \sqrt{\frac{1}{1 + t'\,m}}$. Various philosophers, M. d'Aubuisson in particular, have investigated, by different methods, the resistance air meets with in passing through pipes; M. Péclet subjected the matter to direct experiment. "For that purpose I got chimneys constructed of pottery, sheet-iron, and cast-iron. I varied the diameter and height of them, and the temperature of the air which circulated through them, and I have determined with

great precision the time which the air required to pass through them, from whence I easily deduced the velocity of the air in each particular case. Then comparing the numbers obtained by experiment, I perceived that the resistance to the passage of warm air through channels, was proportioned to the length of the latter, but inversely as their diameter, and directly as the square of the velocity; and I have ascertained the factor by which the velocity assigned by theory is to be multiplied to obtain the actual velocity."

The regular series of experiments was made upon cylindrical chimneys; detached observations, however, upon rectangular ones, indicate that the laws are the same for both, while for those that are compressed, it is only necessary to take the smaller diameter. The factor, then, by which the velocity assigned by theory is to be multiplied to obtain the real velocity of pure heated air, is $2.06 \sqrt{\frac{D}{L + 4D}}$ for baked earth, D being the diameter, and L the length of the canal —$3.25 \sqrt{\frac{D}{L + 10 D}}$ for sheet-iron—and $4.61 \sqrt{\frac{D}{L + 20 D}}$ for cast-iron. If the air is to be considered as half burnt, these quantities respectively, are to be multiplied by 0.97, a term depending on the chemical alteration which influences the density of the air in that state. This is a valuable contribution to practical science, and we trust that it will not escape the attention of the engineers in this country, engaged in the construction of works for which great heat is required. With respect to chimneys, a subject on which no difference of opinion as to theory exists, but the execution of which being unfortunately left, for the most part, to mere builders, comparatively ignorant men, occasions much annoyance in private houses, and serious loss in larger establishments, we found nothing new in the work before us.

An improvement introduced by M. Gourlier, in the Exchange in Paris, having obtained a patent in this country, we rather think the patentee did not anticipate the French architect, but do not recollect the precise date of the specification. The improvement consists in employing grooved bricks of different forms, so that the joints may cover each other, which, when united, may form cylindrical channels of nine or ten inches internal diameter, of sufficient size, consequently, for the purpose of heating and ventilating the apartments, and which may be introduced into the thickness of the walls without impairing their strength. The most valuable inventions and improvements in the arts in England, are not such as meet the public eye. There is too much clashing of interest, too great competition among the manufacturers, to allow of this, and the jealousy with which they regard each other, extends, in a stronger degree, to foreigners. Strangers, therefore, who feel the superiority of England, and while seeing the effects of our national industry, estimate the means of their production by published accounts, invariably overrate our artisans or undervalue our engineers—the former, for executing so much with what are described as not the most perfect

apparatus; the latter, for apparent neglect or ignorance of the support which science affords to every branch of art. M. Dupin, from personal experience, judged more correctly. M. Péclet does not run into either extreme; he speaks highly of the great English establishments; regards, for example, with astonishment, the Scotch distilleries, where, by employing alembics, about 44 inches in diameter, and 5 inches in depth, or from 52 to 54 inches in diameter, and about 8 inches in depth, their contents, 44 and 80 gallons respectively, are heated, completely distilled, and the alembics refilled; the first in two minutes and a half, the last in three minutes and a half; but he seems to think that theoretical refinements are too much overlooked. Now, it is precisely in these details that wholesale operators vie with each other, and it is these secrets which would be, and are, most jealously guarded from every eye. The consequence is, that books on practical subjects are necessarily in arrear—the initiated will not speak, the uninitiated are unable to do so; and M. Péclet, as well as the rest, in describing the various processes connected with heat, has done nothing more than afford the reader a general idea of the means and mode of proceeding. For this, we refer to the work itself, which will be found a valuable addition to every library, and shall insert only a few particulars, which, to us, appear interesting. Having spoken of the calcareous concretions which form on the bottoms of boilers, and used to occasion much inconvenience, he proceeds:—

"A simple and very efficacious method is now known of preventing the incrustations in question; it is to add from 26 to 33 pounds weight of potatoes to the water in a boiler which consumes from 55 to 66 pounds of coal per hour; the boiler may then be employed for 20 or 30 days without being cleaned, and without any fear of a calcareous deposit. After this time the mud must be thrown away, and the same quantity of potatoes again be added. It appears that the fecula, by dissolving in the water, renders this sufficiently viscous to prevent the deposition of the calcareous matter. Flour would produce the same effect, and much less of it would be required."

The following is the most striking instance of its kind that we have met with, which shows how easily the presence of extraneous bodies in boilers tends to injure them.

"A few days after the steam boiler designed to heat the Exchange in Paris was brought into use, it was perceived that there was a hole in the bottom. The fire was extinguished, and it was found, upon emptying the boiler, that the metal was burnt in a place where a rag (*chiffon*,) had been deposited, which had been forgotten when the apparatus was set up."

Our countrymen, who regard with such pleasure the cheering blaze of their domestic hearth, will learn with regret, that, "of all the modes of warming houses, the very worst are open chimneys, then stove-grates, then stoves." The fact is, that in England we regard the appearance of comfort almost as much as the reality, and are frequently content to make some personal and pecuniary sacrifice, sooner than forego the pleasure of *seeing* our enjoyments. Paradoxi-

-cal as it may seem, a person acquainted with human nature will find both sound sense and economy in this, while the heartfelt results of our personal experience will render nugatory the cold calculation of philosophy. But taking into account the national habits, we doubt if any other system of warming houses can be introduced into England than that at present in use. M. Péclet may laugh, as we do ourselves, at Dr. Arnott's absurd speculations in the construction of grates, and the ridiculous monstrosities of Messrs. Atkins and Marriott; he may denounce, and justly, the inordinate and preposterous capacity of our chimneys; but the former are not to be considered as standard specimens of British ingenuity, and the defects of the latter, long since signalized among ourselves, are gradually disappearing in a more rational style of architecture. For large establishments, steam may be employed with advantage; under some circumstances the adoption of stoves may be desirable; but for the general purposes of English domestic life, the open fire-place is indispensable. Nor, adopting the data given by M. Péclet, is any loss of fuel occasioned thereby, when all the purposes for which it is required are taken into account, and the construction that of our best manufacturers. Nations, if not individuals, will gradually improve, as they adopt what their necessities require, anticipating by their practice the suggestions of theory.

"Among the worst conductors must be ranked air, when it is perfectly at rest. Hence, one of the most efficacious means for retarding bodies from cooling, may be easily conjectured, which consists in surrounding the body with one or more envelopes, at a distance from the body, and from each other. The strata of air surrounding the body and its envelopes, without being able to escape, will allow the heat to escape only with extreme difficulty."

Now, this is an exact description of a Chinese tea-pot; a cylindrical metallic vessel closely stopped, inserted in a square wooden box, of at least double capacity, with a cover accurately fitted, and a small orifice in the side, through which the minute aperture of the spout appears. If water boil when poured into this apparatus, more than twenty-four hours are required to cool it.

The mathematical theory of heat, so powerfully developed last year, by M. Fourrier, of the Institute, is not alluded to in the present work. To this subject we shall return at a future time, and in taking leave of M. Péclet, equally admire the ingenuity he has displayed in his own researches, and his judgment in applying the labours of others.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN JUNE, 1829.

With Remarks and Exemplifications, by the Editor.

1. For *Manufacturing Woollen Cloth suitable for Carpeting, Floor-cloths, Rugs, Table-covers, Blankets, Padding,*

and other purposes. First patented March 3d, 1829. Afterwards surrendered for the purpose of correcting the specification, and re-issued June 11th; William Harrington, Harrison, West Chester county, New York.

At page 412 of our last volume, we particularly noticed the original patent. In that specification, the only article proposed to be manufactured was *Woollen Carpet*, or *Carpeting*. In the amended specification, as will be seen by the caption, a number of other articles are enumerated. The mode of procedure is more distinctly explained, and the claim of the patentee thus expressed.

"I do not claim as my invention any one of the machines used in the above described method of manufacturing woollen cloth, nor any particular part of any one of the machines; but I claim that I am the first person who, by passing sheep's wool through the above described or similar operations, and by a combination of the above described or similar machinery, has been able successfully to manufacture woollen cloth of sufficient firmness of texture, strength, and durability, to answer the valuable purposes named in this specification, without spinning, or weaving, upon the principles of felting. The subscriber is not aware, that any one has heretofore been able successfully to avail himself of the well known felting properties of sheep's wool, for the purpose of manufacturing cloth, suitable for carpeting and other valuable purposes named in this specification."

Within two months, five patents, we believe, have issued for a purpose similar to the foregoing; we are therefore likely to have the practicability, or rather the eligibility of the thing fairly tested; and it is highly probable also, that the claims of the patentees to originality, may likewise have to pass the ordeal of the law.

Numerous attempts have been made, and large sums invested, in this manufacture. A patent was obtained in England, for the manufacture of cloth by felting, upwards of thirty-five years ago, and several different establishments formed, but all eventually abandoned, because the cloth made, was less durable than that which was woven.

We recollect a similar attempt made in the vicinity of Philadelphia about thirty years ago, by two Englishmen, who came over with the express determination of establishing the manufacture. We saw specimens of the cloth, the appearance of which was good; but the state of the country was not then favourable to such a project, and the intrinsic defect of want of strength in the texture, was urged against it.

The claim of the present patentee, is, as appears to us, to his having succeeded; we hope this claim may be a durable one. In the enumeration of the articles, his new patent is much broader than the old; the correctness of this admits of some doubt; we have always entertained the opinion that an amended specification may omit old, but ought not to contain new claims; and that the principal intention was to afford an opportunity for giving that precision and clearness to the instrument which had been at first unwittingly neglected.

2. For an improvement in the manufacture of *Glass Knobs for Drawers*, Doors, Shutters, &c.; Deming Jervis, Boston, Massachusetts, June 11.

The glass knob, instead of being perforated, in the usual manner, for the reception of a metallic screw, is pressed into a mould, so made as to form the knob with a shank of solid glass, furnished with a screw. On account of the brittleness of the material, the shank is made large. The claim is to the making of glass knobs, 'having a glass shank, with a screw upon the shank.'

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3. For a *Washing Machine;* Fredus Reed, Piketown, Bradford county, Pennsylvania, June 11.

The trough in which the clothes are to be washed, has an iron shaft extending its whole length, supported by, and working in, two uprights. This shaft is placed above the back edge of the trough, and has on it four cranks, standing at right angles to each other. The washing is effected by four paddles, the upper ends of which are attached to the cranks, whilst their lower dip into the trough, and agitate the clothes, the back edge of the box serving as a fulcrum, or thole, for the paddles.

"What I claim as my invention, is, the application of the crank shaft to the paddles, or arms, so as to cause them to operate alternately, as above described, said paddles not having been heretofore employed for the washing and cleaning of clothes." And it is much to be doubted whether they will be employed hereafter.

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4. For a machine for *Thrashing, Smutting, Winnowing, and Screening Grain*, called 'Davis and Carey's improved Thrashing Machine;' Elisha P. Davis, and William Carey, Riga, Monroe county, New York, June 11.

In general structure this machine is similar to many others, but its particular arrangements could not be shown without a drawing. The thrashing cylinder is to be covered with sheet iron, punched like a grater, with the burs projecting outwards. The hollow segment, opposite to which it revolves, is to be similarly lined; this is to cause it to operate as a smut cleaner. Spikes of two inches in length project from each, for the purpose of thrashing out the grain, which, with the chaff, falls through a screen into the winnowing chamber. A cylinder, provided with spikes, revolves, and removes the straw.

The patentees do not claim the invention of effecting either of the processes by machinery, nor any of the arrangements of parts which may be found in other machines, but only the particular combination by which all are performed in this machine. They claim the covering of the cylinder and segment with sheet iron, to serve as a smut machine, and to protect them from wear. They mount the cylinder on steel points instead of journals, and this they claim. They also claim the screwing of the spikes into the cylinder and segment, in-

stead of driving them; this is to prevent their flying out. The regulating the distance of the cylinder from the segment, by means of screws and springs, instead of wedges, is likewise claimed.

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5. For sundry new and useful improvements in the construction of *Rail-ways, and Rail-way Carriages;* Isaac Knight, Baltimore, Maryland, June 11.

The objects embraced, are too numerous to be inserted here. The description of them occupies a dozen pages, which we will endeavour to condense, and publish; probably in the present number.

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6. For an improved mode of *Producing Fire and Light;* Isaiah Jennings, New York, June 11.

Sulphuric acid is to be hermetically sealed in a small glass tube or bulb, and this is to be enclosed in a paper, surrounded by a mixture of oxymuriate of potash, sulphur, and sugar, or other ingredients which will inflame by the contact of sulphuric acid. The paper may be oiled, waxed, or varnished, and folded up, to serve the purpose of a match. To light this match, the included glass is to be broken, which brings the acid in contact with the inflammable materials. The advantage presented by this plan, is, the preservation of the acid for any length of time; the disadvantage, that such matches will be too costly for general consumption.

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7. For an improvement in the *Construction of Lamps, and the Economy of Light;* Isaiah Jennings, New York, June 11.

The lamp referred to in the specification of this patent, resembles one for which Mr. Jennings obtained a patent on the 3d of March last, and, like that, is principally intended for the burning of tallow, and other thick fatty substances. A globular body of glass is to contain the fat or oil. A copper tube of half an inch in diameter passes through a cork, fitted into an opening in the lower part of this body, and extends up so as to stand even with its upper surface, which has an opening of about 1¼ inch in diameter, so as to allow a space around the metal tube. This tube is surrounded with folds of cotton, to answer the purposes of a lamp-wick, so far as capillary attraction is concerned, but terminates about half an inch below the top of the copper tube; above this a short piece of circular wick is put on, which is to extend a little above the top of the tube, for the purpose of being ignited. There is no means of raising this wick, as it is to be renewed when necessary. The patentee has engaged to send one of his lamps for trial, when, should it justify the character which he gives to it, we will furnish an exact description of it with a drawing.

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8. For an *Hydraulic Steam Engine;* John Catlin, Cincinnati, Hamilton county, Ohio, June 11.

This is in fact an engine working entirely upon the principle of Savary's engine. It is said to be "peculiarly applicable to mills already erected on streams which fail during part of the year, as the expense of constructing it is much less than of an ordinary steam engine of equal power."

Savary's engine, as usually described, was to operate both as a sucking and forcing pump. The water being first raised, by the pressure of the atmosphere, into a chamber, in which a vacuum had been produced by the condensation of steam, and then forced up a rising main by the pressure of steam acting upon the surface of the water. In the arrangement now proposed, the forcing operation is the only one employed. Two or more cylinders are made of wood, and are placed in the reservoir from which the water is to be raised, so that it will flow into them without the aid of a vacuum. Wood is chosen because it is a bad conductor of heat. Floats of wood are to rise and fall within these cylinders, and are to operate as pistons; they are to be "closely fitted without touching the sides, to separate the steam from the surface of the water, and thereby prevent its condensation." After these cylinders have been filled with water, through a valve in their bottoms, steam is to be admitted into them, above the float, and is, by its elasticity, to force the water to the required height. The patentee says:

"The improvement for which I claim exclusive privilege, is, the use of wood, or other non-conducting materials, to construct the vessels, or cylinders, and floats, above described, and to line with the same material, iron, or other metallic vessels, or cylinders, for the alternate reception and discharge of steam and water."

It will be no easy task to *fit the floats closely without touching the sides*, so as to prevent the water from passing above them, when under the pressure of a high column in the rising shafts. The slowness with which wood conducts heat, would be an advantage in this plan, but the impossibility of making it keep its form and dimensions under the action of water and steam, will render some unmentioned provision necessary, or it must be fatal to the whole scheme. Steam of two atmospheres will be necessary to raise water to the height of thirty feet upon this plan.

In situations where fuel is cheap, an economical engine for raising water from a tail race, into a dam, might be advantageously employed during seasons of drought; but it rarely happens that there is a supply in the tail race, when there is a deficiency in the dam; it is therefore in but few places that such an apparatus would be of any avail; it has, however, been effected in some places, but the very nature of things forbids its frequent adoption.

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9. For an improved *Cotton Gin;* Stephen T. Conn, New York, June 11.

The roller cotton gin consists of two rollers, about sixteen inches in length, which are made to turn something like the rollers of a flatting mill. The seed cotton being forced against these, the cotton

is drawn through the rollers, and the seed left behind. Such rollers, it is stated, become heated in use, sufficiently to set fire to the cotton. The improvement claimed is to the making them hollow, so as to admit air freely, which, the patentee avers, will obviate this objection. If desired, a current of air, or even of water, may be made to pass through them.

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10. For a *Cast Iron Cooking Stove;* Allen and James Barnett, Louisville, Jefferson county, Kentucky, June 11.

This is an ingeniously constructed stove, and probably a very good one. The fire is placed immediately below the *upper* plate, and there are perforations in this plate for kettles, pans, &c. The oven is *below* the fire, and the flame and smoke are made to descend by four flues, one at each corner, forming a semicircular projection at each angle of the stove. These flues are carried under the oven, so as to distribute the heat equally, and the smoke at length escapes by four contiguous openings at one side, and at the bottom of the stove, where a common pipe connects them with the chimney.

The claim is to "the *projecting flues,* which render the fire department more square and compact than any other. The advantage derived from *four flues,* by which the flame, or heat, is drawn from the centre to each corner of the fire department, passing with great regularity under the boilers, and then descending and passing through the horizontal flues, by which it is distributed with unequalled regularity and effect, under the oven; the said horizontal flues being connected, and cast with the bottom plate of the oven."

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11. For an improvement in the *Bar-share and Shovel Plough;* James Boatwright, Columbia, South Carolina, June 11.

A bar, or plate, of wrought iron, from four to ten inches wide, and from fourteen to sixteen inches long, is to have its ends cut off obliquely, so as to form an angle of about 46 degrees with the sides; these ends are to be steeled and sharpened. This plate is to be bent in a regular curve, lengthwise, upon a cylinder of about twenty-one inches in diameter. The plate, or share, is then to be bolted on to the helve, or chip, with one edge downwards. The specification states, that,

"Among the advantages of this improved share, the following may be enumerated. Either end may be used, or the form of the ends may be varied, so as to be applicable to different purposes; it may be used either with or without a coulter, as circumstances require; it requires no mould board; is light, effective in its operation, and simple in its construction."

"What I claim as new, and an improvement, in this plough, is the form of the share, which can be used at either end, and which, by its peculiar form, acts as a mould board and share, consequently supersedes the necessity of attaching a separate mould board."

This plough is said to answer well in the district of country where the patentee resides. Where the soil is light, and the ploughing is

intended to be shallow, we have no doubt of its adaptation to the purpose; and this we presume is all that is expected by the inventor.

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12. For an improvement in the *Rail-road*, by which a railway carriage may be made to turn out and in, at the places intended for that purpose, on a single rail-way; or to pass from one track to another, where the road is double; which mode obviates the difficulties heretofore experienced in effecting this object; James Wright, Columbia, Lancaster county, Pennsylvania, June 11.

A plate is in the hands of the engraver, to accompany the specification of this patent, and the one obtained by the same gentleman, in April last.

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13. For an improved *Rifle for sharpening Scythes* and other edged tools; Beriah Swift, Washington, Dutchess county, New York, June 11.

Emery of a suitable size is to be fixed upon properly shaped strips of wood, by means of a mixture of oil-paint, and varnish, which, when dry, forms the substitute for the stones usually employed.

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14. For an improvement in manufacturing *Wool, or other fibrous material,* being a method of taking the wool, or other material, more readily from the doffer than heretofore; John Goulding, Dedham, Massachusetts, June 11.

Small rollers, covered all over with fillet card-wire, are placed in front of the doffer cylinders, from which they take the wool, and deliver it into small revolving tubes, through which it is drawn by fluted rollers. Reference is had to a patent formerly obtained, and upon which this is an improvement; figures of both would be necessary to a perfect description.

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15. For an improvement in the *Commode Knob*, for drawers, and other articles of furniture; Elijah Skinner, Sandwich, Stafford county, New Hampshire, June 11.

This *improvement* consists in using turned wooden knobs, around which ferrules of brass are to be put, and circular plates of brass let into their faces, and polished. Economy is the object in view in this *invention*.

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16. For a machine for *Thrashing Grain, or other substances,* called 'Fuller's Portable Thrashing Machine;' George Fuller, Gardiner, Kennebeck county, Maine, June 11.

A horse, ox, or other heavy animal, is to travel upon an inclined wheel, which by bevelled gearing is to give motion to a thrashing cylinder, with beaters, and also to a feeding apron, just like other

thrashing cylinders, and feeding aprons. The whole is to be placed upon truck wheels, so that it may be drawn about from place to place.

"I do not claim a right to the inclined wheels, or to the beaters; but I claim as my invention, the particular combination of machinery attached to the inclined wheel, for moving the beaters, for the purpose of thrashing grain, &c."

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17. For an improvement in the *Hollow Auger*, for tenoning the spokes of wheels; Abel Conant Pepperell, Middlesex county, Massachusetts, June 11.

After the spokes of a wheel have been driven into the nave, or hub, the ends which are to pass into the rim have to be rounded. This is frequently done by a hollow auger, which leaves the tenons in the form of round pins; it is this hollow auger upon which improvements are now claimed. The auger is to be made in two pieces. The front piece, upon which is formed the cutting face, is so perforated from end to end, as that the hollow may be in the form of the frustum of a cone, the smaller end being towards the cutters; this is for the purpose of avoiding friction from the tenon within the hollow. The back part of the auger is solid, one end being fitted and fixed into the larger end of the conical part. The back end of the shank is squared, to fit a common bit stock, with which it may be turned. The auger is fitted into two collars, like the mandrel of a lathe; in these collars it has a traversing motion. The hub, with its spokes, are to be fixed to turn on a centre, and the spokes are brought in succession opposite to the hollow auger, properly fixed and adjusted for the purpose of cutting. There is a collet upon the shank of the auger, behind the back collar; this, when the auger has bored far enough, comes in contact with the collar, and all the shoulders are, consequently, at precisely the same distance from the centre of the wheel.

The form of the cutting edges, of which there are two upon the face of the auger, differs somewhat from that ordinarily given to it.

The claims are to making the auger in two parts;—making the inside conical;—giving to the cutting edges a more curved form than usual, and the mode of supporting and using the auger.

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18. For a *Machine for Making Hat Bodies;* Hiram Chase, and Alexander Clark; the former of Tisbury, in Dukes county, the latter of Falmouth, in Barnstable county, Massachusetts, June 11.

The wool is carded upon the ordinary carding machine, but is taken off from the main cylinder by *conical* doffing rollers, covered with cards, there being two of these doffing rollers, one under the other, in front of the cylinder, their larger ends standing in reversed directions. Steel doffing plates remove the wool from these conical rollers, when it winds around conical formers placed ready to receive it. Against these conical formers it is pressed by a second cone,

which bears up against the *former*, on the side opposite to the doffing comb; this pressure gives to the body sufficient solidity, to enable it to be removed from the former.

A vibrating motion is given to the carding machine for the purpose of regulating and varying the thickness of the body. To accomplish this object, the supports of the forming rollers are not attached to the carding frame, but to the floor, by a distinct frame.

The claims are:

"1st. The application of the two conical doffing cards, for the purpose of taking the wool from the main cylinder."

"2nd. The moving, or vibrating the carding machine, for the purpose of varying the thickness of the body."

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19. For *a Churn;* Cotton Foss, Perry, Geauga county, Ohio, June 11.

This churn is made in the form of the common dasher churn, but larger. The head is to be secured on by a cleat; a shaft passes through the head, which is to be turned by a crank, in the manner of the ordinary barrel churn; revolving dashers, placed spirally, are attached to the shaft, within the churn.

The body of the churn is to be laid upon a bench, standing obliquely, its axis forming an angle of about 35 degrees with the horizon.

The spiral direction of the floats, or dashers, and the oblique position of the churn, form the claims.

From good cream, this churn may make good butter, as quickly as other churns, and with as little waste, provided the loose head be well fitted and secured, and the cream do not escape at the shaft.

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20. For a new and useful mode of *Propelling Boats, or Wagons;* Josiah White, civil engineer, Mauch Chunk, Pennsylvania, June 11.

The principal object of this invention is to use propellers of timber, to cause wagons or cars to ascend on an inclined plane, instead of drawing them up by ropes, or chains.

The propellers are long pieces of timber, placed between the ways of a rail-road. They are to be three in number, lying side by side, and may be on the same plane with the rails; they are proposed to be made of timber, about 6 by 8 inches, and may be so joined end to end as to extend to any convenient distance; they are to be supported on rollers, upon which they are retained by flanches. A shaft crosses the rail-road, below the rails and the propellers; upon this shaft there are three cranks, from each of which a pitman passes to one of the propellers, and when this shaft is turned, by the application of any sufficient power, one of the propellers will always be advancing. The upper edges of these propellers are notched, so as to form ratchets; and three palls descend from the bottom of the

wagon, and fall into these ratchets, which will, of course, cause it to ascend by a regular, continuous, motion.

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21. For a *Cider-press;* Daniel Pride, Potsdam, St. Lawrence county, New York, June 11.

This is a rack and pinion press. Within each cheek there is an iron rack, and two pinions mash into these racks, the pinions being fixed on the ends of a shaft which crosses the press, and the gudgeons of which turn in the cheeks. This shaft carries also two cog wheels, which are operated upon by two other pinions upon a second shaft, above the former. A handspike, or lever, passing into mortise holes in this upper shaft, serves to work the press, and a weight suspended from the end of this lever, will, when wanted, keep up a continuous pressure.

We have never yet found two oak leaves exactly of the same form, and in like manner we may aver that this press does not precisely resemble any other which we have seen; still we are at a loss to tell in what part of it there is any new combination upon which to rest a claim to an exclusive right. The patentee appears to have been in the same predicament with ourselves, as he has not claimed any thing.

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22. For a *Rotary Steam Engine;* David B. Lee, and Stephen Stewart, Philadelphia, June 11.

The principle upon which this engine is to act, is the same which has been tried in a great variety of forms, and always with the same result, namely, that it would go, if well made, but was inferior in operation to the cylinder engine. We cannot give the particular arrangement proposed, without drawings, and deem it sufficient to observe, that a wheel is to revolve, upon the periphery of which there are valves, which shut flush into it, and are to open and be acted upon as they pass through steam boxes, of which there are two, one standing opposite to the other, and each furnished with a steam and escape pipe.

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23. For an Haemagalactiphorus, being a new and useful improvement in the *Method of Topical Blood-letting, and Drawing Milk from the Breasts of Women;* David W. D. Houghtaling, M. D. and Andrew Meneeley, Mathematical Instrument Maker, Watervleit, Albany county, New York, June 11.

This instrument consists of an exhausting cylinder, and a cup into which it screws. When applied to the breast, the cup is to be of such size as to receive it, when the raising of the piston will produce a vacuum. The rod, or stem, of the piston has a screw cut upon it, its whole length, and it is to be raised by a thumb screw, bearing upon the cap of the cylinder, which operates in the most gentle manner, and retains the piston in its place. The cup is made double; that is, there is one cup within another, there being a small space,

say $\frac{1}{16}$ of an inch, between them. The inner cup is perforated, all over, with minute holes; the object of this arrangement being to admit of the effect of the exhaustion being felt over the whole surface of the breast. The piston, and indeed the whole instrument, is without a valve.

When a small surface only is to be operated upon, the cup is unscrewed, and the open end of the syringe, with the piston down, is applied over the part.

The claim is to the rod and thumb screw; the double cup, and the application of the open syringe.

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24. For an improvement in *Bedsteads;* John P. Copcutt, New York, June, 11.

A right hand screw is fixed upon one end of each rail, and a left hand screw upon the opposite end; to receive these, plates, with female screws, are let into the posts. The operation is plain, and it undoubtedly was *once* a novelty; when, we know not, but do know that it has been patented more than once.

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25. For a *Washing Machine,* called the "Safe Washer," for the washing of cloths and clothing, and the scouring of the same; Ephraim Wheeler, Galway, Saratoga county, New York, June 11.

Six closely written pages contain a complete description of 'the safe washer.'

"The improvements claimed by the said inventor, to be contained in the machine, are as follows:—

"*First.* The peculiar shape of the sink as applied to the purpose of washing in this machine.

"*Second.* The operation, by pressure, of such a large cylinder, on such small ones as are contained in said machine as described, for the purpose of washing cloths or clothing."

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26. For an improvement in the use of *Flat Boilers for Generating Steam;* Daniel Fanshaw and Horatio Hanks, New York, June 11.

The flat boilers which the patentees propose to improve, are thin quadrangular boilers placed on their edges, with the fire between them. There may, for example, be four such boilers, which have water pipes near their bottoms, connecting them with each other, and steam pipes uniting them together near their upper parts. The water, it is stated, has, heretofore, been forced into one of these boilers, and left to flow into the others through the water pipes. The middle boilers being the most exposed to the action of the fire, have highly elastic steam formed in them, which, by its force, frequently prevents the flow of the water into them, a circumstance pregnant with danger, and preventing the regular action of the engine. The improvement is the forcing of water into each of the boilers indepen-

dently, which is said to obviate all the difficulty heretofore experienced.

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27. For a new *Pegging Machine*, with plates, for making boots and shoes; Nathan Leonard, Merrimac, Hillsborough county, New Hampshire, June 11.

This machine consists of a press to be forced down by a lever. A metallic plate is prepared, in the form and of the size of the sole of the boot, or shoe, to be pegged. This plate is perforated with holes, corresponding with the pegs to be driven. Two other plates are prepared, one of which is furnished with awls, which are to pass through the holes in the first plate, and perforate the sole. The second plate is furnished with metal pins, with flat ends, which also fit into the holes in the first plate. When the boot is properly placed in the press, the perforated plate is laid upon the sole, and secured in its place; the plate with awls is then laid on, and pressed down; when this is removed, a peg is placed in each perforation of the plate, and that which has the pegging pins, with flat ends, drives the whole of them home at one operation.

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28. For an "*Improved Rope Maker*," being a machine for making ropes and cords of all sizes; Stephen Hills, 2nd, Glastonbury, Connecticut, June 11.

(See specification.)

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29. For a machine for *Breaking and Cleaning Hemp and Flax;* Reuben Medley, Bloomfield, Nelson county, Kentucky, June 11.

This machine is intended to operate by horse, or any other suitable power. It has a drum with three beaters, or breakers, formed of strips of wood, defended by plates of iron; after being operated upon by these beaters, the material passes from them between fluted rollers, which meet each other just opposite the edge of the breast beam, upon which the beaters act. Upon the same shaft which carries the drum, and about 2 feet from it, there are lifters which raise a brake, with slats upon its under side, which work between fixed slats below, like the common Dutch brake. Beyond the lifters, knives, about 18 inches long, extend out from the shaft; these knives have dull edges, which work against a spring board, upon which the flax, or hemp, is to be cleaned. The claim is to "the whole of that part of the machine which operates in the breaking of the hemp, or flax."

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30. For an *Improvement in Stoves;* William Naylor, New York, June 11.

This stove is formed in front like a parlour grate, for an open fire, and is to be used with any kind of coal, or with wood; anthracite coal being preferred. Behind the fire there is an oven, boilers, and

other appendages, arranged after the manner of a ship's camboose. The whole seems to us to be compact and well arranged; its appearance, as represented in the drawing, is handsome; its parts, however, are too numerous for verbal description.

Several very excellent cooking stoves have been invented in New York, and this, we think, will add one to the list.

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31. For an improvement in the *Plough*, by which the sides of hills can be ploughed backwards and forwards, throwing the ground always on the same side of the furrow; Philip Altenderfer and Benjamin Altenderfer, Richmond, Berks county, Pennsylvania, June 11.

The specification tells us that "there is a beam with a double mould-board, pointing both ways, but both facing on the same side; two shares, and two coulters, also pointing in opposite directions, the space between the shares being closed, and also the mould-boards closed on the land side. To the above mentioned beam there is another beam [attached] which runs, or rather revolves, upon a pivot in the centre of the first mentioned beam. To the latter beam the handles are attached, and when it is desired to turn the horses, it can be done at pleasure. The upper beam is secured upon the lower by a screw upon the pivot, and by an iron pin at the end to which the handles are attached, which may be drawn out at pleasure whenever it may be desirous to change the direction."

Who was really the "original inventor or discoverer" of this plough, we do not pretend to know, but by turning to page 116, of our last volume, it will be seen that a patent was obtained by a certain John Cromwell, of Maryland, in 1816, for a plough as much like the foregoing, as one pin is like another. We should advise our agricultural friends who wish to buy rights, to deal with Mr. Cromwell, who, as his patent is just expiring, will undoubtedly sell cheap, whilst the Messrs. Altenderfer, having a *new* patent, must be paid accordingly.

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32. For an improvement in the form of *Boxes for the Wheels of Post Coaches, Carts, Wagons, and other Carriages;* called the "Cylindro-conical, Self-wedging, or Self-fastening Box;" Thomas Mussey, New London, Connecticut, June 11.

This is one of those simple and obvious improvements, which, when once presented to us, excites our surprise that it should not have been made long ago. The improvement is upon the form of the exterior of the cast-iron boxes in common use. These have, heretofore, been cast tapering on the outside, as well as within, but in the reversed direction, and they have been so made, because, in this form, the pattern, in casting, would readily deliver from the mould. When thus cast, the smaller, or front box, has its exterior diameter smallest at the end towards the centre of the hub, or nave; the consequence of which, is, that the least start, after it has been driven

into its place, loosens it in every part, and it readily comes out. The larger box, on the contrary, has its larger diameter towards the centre of the nave, and cannot, therefore, be driven into its place, but must, necessarily, be secured by wedges, which are very apt to work out. The patent boxes are made perfectly cylindrical on their outsides, with the exception of a small distance from the end which is first to enter, where they are sufficiently tapered, or chamfered, to prevent their cutting the wood before them. The ears, or projections, which are to prevent the boxes from turning, are made sharp on their inner ends, and, when driven, force their own passage way.

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33. For an improvement in the *Cast-iron Plough;* Jacob Minturn, Urbanna, Champaign county, Ohio, June 11.

This plough looks so much like many others, that it would puzzle an adept in the science of Lavater to discover, from its countenance, any difference in its disposition from many members of the same family. The patentee tells us that "the improvement here claimed, as aforesaid, differing from other ploughs now in use, particularly when the share joins the mould; the mould rests on the share more than twice as high on the left as what it does on the right hand side, so as to form the whole into a regular curve for turning the soil. Also, the hook projecting from the mould, and supporting the hinder part of the share; the mould also differs from others now in use, but which difference I do not claim."

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34. For an improvement in *Spinning Hemp, Flax, Cotton, Wool,* and other materials capable of being wrought into thread, yarn, &c. by means of a machine called the "Spiral Self-supplying Twister;" Walter Hunt, New York, June 11.

This is a peculiar kind of spindle, with its appendages, which appears to be principally designed for the spinning of hemp and flax. We have not, from the drawings and description, obtained a very clear idea of its mode of operation, nor could this be explained without engravings. When a model is received, it may obtain further notice.

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35. For a machine for *Shelling and Cleaning Indian Corn;* John S. Gardner, Canandaigua, Ontario county, New York, June 11.

The corn is to be shelled by passing between a wooden cylinder, with projecting spikes, and a concave segment of a curve, formed of wood, and furnished also with spikes. There are springs to adapt them to each other for the varying sizes of the ears of corn. The corn is to be put into a hopper, and carried to the cylinder by a feeding apron; it afterwards falls upon a screen, which separates the grain from the cob, and a fan completes the cleaning.

There is no particular claim, and although the machine appears to

be a good one, we apprehend that it is not novel in *all* its parts. The first machine for shelling corn, invented upwards of twenty years ago, had a cylinder perfectly similar to the one here described, although it was, upon the whole, a much less perfect instrument.

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36. For an improvement in *Water and Paddle Wheels;* Benjamin Howard, Worcester, Massachusetts, June 11.

This is similar to the wheel for which a patent was obtained by Adolph Heilbronn, of New York, which is described in the present number, with engravings. The difference between them is in the details merely.

The coincidence in the peculiar construction of the wheels is a remarkable one. The priority in the time of application, and in the date of the patent, belongs to Mr. Heilbronn; the originality of invention is a question for others to determine.

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37. For an improved *Plough,* called the 'Diamond Plough;' John Rhodes, Urbanna, Champaign county, Ohio, June 11.

That others may discover where the merit of the invention lies, we give the whole specification, as it is short. All the peculiarity that we perceive in it, is, that the mould board is made partly of iron, and partly of wood; it being widened out at top, by means of the latter material.

"John Rhodes' newly invented plough, differs from other ploughs now in use, as follows: The land-side and share are of wrought iron, and laid with steel; the wing welded to the bar in front, and raised so as to form the principal part of the mould, extending back to the right handle, and fastened to said handle with a bolt and screw; also a piece of wood extending from the sheath to the handle, and fastened either with a screw or rivet, and placed on the top so as to form the balance of the mould; also a bolt with a screw passing through the mould and sheath, connecting them together; the bolt connecting the beam and share together locking in the socket; the coulter being locked on the point of the share, and fastened to the beam on the land-side with a clamp and two screws. This plough may be used with or without a coulter." JOHN RHODES.

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38. For an improvement in the *Application of the Scape Heat from the High Pressure Steam Engine, to the Manufacture of Salt.* For which a patent was obtained October 30, 1827; Alexander Brown, Salina, Onondago county, New York, June 11.

The specification will appear in the next number.

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39. For an improvement in the *Construction of Fire Arms,* viz: Rifles, Muskets, Fowling Pieces, Ordnance, &c.; James Miller, Brighton, Monroe county, N. Y. June 11.

This gun is very similar to that of Rogers, and to Wheeler's (see p. 124.) A revolving chamber, containing seven charges, is placed behind the main barrel. Each of the perforations in this revolving piece has its touch hole, and its percussion priming.

"The improvement relied on in this machine, consists in the simplicity of its construction, every way adapted to hunting, and for war purposes."

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40. For an improvement in the making, or manufacturing, of *Blanks for Checks, Drafts, or Bills of Exchange;* James Atwater, Nathaniel Jocelyn, and Simeon S. Jocelyn, New Haven, Connecticut, June 11.

This is the invention of which a notice appeared in Silliman's Journal, and which notice we re-published in our last volume, p. 145. A new patent, containing some improvements in the former plan, is now about to issue, to the same gentlemen. From the nature of the invention, we shall avoid publishing any particular description of the plan, without the special sanction of the patentees.

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41. For an improvement in *Bellows Tubs, or Cylinders,* for Furnaces, or Forges; Andrew A. M'Pharrin, Huntingdon, Pennsylvania, June 11.

The specification of this patent gives but a confused description of the invention; but the drawing is pretty well executed, and from this it appears that the part called the tub is a single cylinder, having a thick diaphragm in the middle, perforated in the centre, to allow a piston rod to pass through it, and having a double valve, closing a square hole, communicating with each division of the cylinder; between these valves, in the thickness of the diaphragm, a nozzle, or wind pipe, passes out through the side of the cylinder. The piston rod is worked by a crank, connected with a pitman, below the cylinder; upon the rod which passes through the diaphragm, there are two pistons, one above, and the other below it, each piston having a valve opening inwards. It is evident, therefore, that the action of the cylinder, with its double chamber, is analogous to that of the ordinary double bellows, but that it must have the defect of an entire, though momentary, stoppage of the blast at every return stroke. To obviate this, there is upon the wind pipe, a cylindrical chamber, with a weighted piston, to serve as a reservoir for the wind; the loaded piston acting like the upper board of the double bellows. In the wind pipe, there is a damper, which may be closed, or opened, to regulate the exit of the wind.

We do not perceive the superiority of this arrangement, to that of other cylindrical bellows, and are very apprehensive that this patent, like many others, has been obtained by one who is not acquainted with what has been elsewhere done in his own business. The common plan of three separate cylinders, which keep up a continued

blast, seems to us to be altogether superior to the mode here proposed.

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42. For a machine for *Sweeping or Cleaning Chimneys;* Samuel Dow, Elizabethtown, New Jersey, June 11.

There is an elastic rod, made in joints, so that they may be attached to each other as they are passed up a chimney; upon the upper of these there is a block, to which the handles of four, or more, brushes may be fastened, so as to branch off in different directions; these handles are also elastic; the brush part is to be formed of bristles, whalebone, or any other suitable material. Just below the brushes there are attached pieces of iron, which are to operate as scrapers.

The claim is, to "the machine, or broom, in all its parts, as applied to the sweeping and cleaning of chimneys."

From the days of Jonas Hanway, to the present, attempts have been made, particularly in England, to construct a machine to obviate the necessity of 'climbing boys,' and we have no doubt, that upwards of fifty machines for this purpose have been offered to the public; there has been a general feeling in their favour, upon principles of humanity. The one now proposed, strongly resembles some of the earlier attempts in this way; these, however, and many others, with an aspect of greater promise, have been abandoned, in consequence of the impossibility of adapting them to the endless variety in the form, direction, and size of chimneys.

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43. For an improvement in *Bedsteads;* Ebenezer Rogers, and Michael Pearson, Essex county, Massachusetts, June 11.

This *improvement* is similar to Mr. Copcutt's, No. 24, excepting that the right and left handed screws are, as in days of yore, of wood, instead of brass. How each of the two patentees has managed to exert his mental powers on the re-contrivance of this 'modern antique,' it would be difficult to divine, excepting on the supposition, that one of them has invented the *right*, and the other the *left* handed screw, it not being the mode of forming, but the mere application of these screws, which they claim; they say, that "the only thing for which your petitioners would wish letters patent, is the application of the right and left handed screws in the construction of bedsteads."

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44. For an improvement in the *Mode of Crimping Boots;* Thomas Howe, Worcester, Massachusetts, June 11.

A crimping board, similar to that ordinarily used by cordwainers, has the leather placed upon it in the usual way. The crimping board is then applied to the machine, which is the subject of this patent. This machine consists of a frame of wood, having on the upper part of it two jaws, between which the crimping board

is to be drawn. These jaws open and close by means of a screw attached to each. On the lower part of the frame there is a roller, which is to be turned by means of a crank; from this roller two chains proceed, one of which is to be hitched to the top, and the other to the toe, of the crimping board, which has staples attached to it for that purpose. When the board is fixed between the jaws, the crank is turned, and the board and leather are consequently forced down, and the latter crimped; it is then taken out, and permitted to dry.

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45. For a mode of *Applying Heat, by means of Iron Castings* and grates, connected together, and adapted to the uses of cookery, or otherwise, and set in a fire-place; called a 'Fire-place Furnace;' Peter E. Sanburn, Troy, Rensselaer county, New York, June 11.

This is a kind of flat, cast-iron, box, made to fit a fire-place, and having an upper plate, upon the middle of which the fire is to be built. In the centre, just under the fire, there is to be an enclosed iron drawer, in which articles to be baked may be placed, whilst kettles, &c. may be hung over the fire, as in the ordinary fire-place. The ends of this cast-iron box, beyond the centre drawer, have their upper parts formed of bars, or grating, and may have placed upon them any cooking utensil. How these are to be heated from below, we do not perceive.

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46. For an improvement in the *Manufacture of Combs;* John Brown, Providence, Rhode Island, June 11.

It is proposed to make fine toothed combs out of small scraps of ivory, which are of little value; pieces sufficiently large to form one row of teeth, leaving a narrow back to connect them together, answering the intended purpose. Two such pieces, when cut, may be joined by an intermediate piece of hard wood, horn, or any other suitable substance, to which they may be attached by cementing, or otherwise.

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47. For the *Manufacture of Raw or Green Hides, into a Hard and Transparent Material,* suitable for the making of combs, snuff-boxes, lanterns, veneering for furniture, &c.; Samuel Pike, Providence, Rhode Island, June 11.

The process, by which the patentee proposes to effect his purpose, belongs to the class of those, which we think it improper to publish without his consent.

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48. For making *Boxes and Gudgeons, of Cast-iron, Wrought-iron, or Wood,* for saw mills, grist mills, horizontal and vertical wheels, wagons, carts, or any description of wheel

carriage, whether driven by water, steam, horse, or other power; Sullivan Reynolds, Guilford, Chenango county, New York, June 11.

This imposing title precedes a claim to the use of lead for the lining of boxes, or inks, within which gudgeons are to run. This material has been frequently used for the purpose, and in some cases, answers remarkably well, as smooth iron, or steel, runs upon it with but little friction. For very heavy machinery, as for the gudgeons of mill wheels, the loading causes the lead to spread; and in machinery where there is much jolting, or percussion, as in carriages, a similar effect is produced by the repeated blows. Where there is grit, it insinuates itself into the lead, and causes the wearing or cutting of the gudgeons.

We are now speaking of what we have known for more than thirty years; in part from our own practice, and in part from that of others, to whom it was then old.

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49. For a method of *Preventing Bed-bugs from Ascending the Posts of Bedsteads;* James Alexander Cook, Georgetown, D. C., June 13.

A cup and socket of tin is to be placed under each post. This cup and socket is in the form of a flat candlestick, the socket part being sufficiently large to admit the post of the bedstead, and the dish part surrounding the socket, serving to contain, oil, water, or other fluid, over which the vermin cannot pass. A cap like the nozzle of a candlestick, with a rim sufficiently wide to extend over the cup containing the liquid, and prevent the falling of dust into it, is fitted to the top of the socket, or on to the leg of the bedstead. The bedstead must be removed from the wall, and the clothes prevented from touching the floor, when the cups are used.

The claim is to the inner socket, and to the cup. The patentee calls his dishes and caps 'Night Angels.' A name given, we presume, because they are to keep guard at the four corners of his bed, and prevent the approach of the Imps of Satan. The best defence against these nocturnal tormentors, is cleanliness, and those who lack the industry necessary for their destruction, will, we are apprehensive, call in vain, either upon Hercules or Mr. Cook's 'Night Angels,' to protect them from the fangs of these disturbers of their repose.

The effect to be produced by these *Night Angels,* we have repeatedly attained by a *magic circle,* around the lower end of each bed post. This circle was merely a line made with chalk, over which the legion cannot pass. The loose particles upon which they tread, giving way beneath their feet, and precipitating them to the lower regions.

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50. For an improvement in Spinning, called the *Running*

Cap Spinner, intended for spinning cotton yarns, and roping; John Thorp, Providence, Rhode Island, June 11.

(See specification, p. 130.)

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51. For the manufacture of ornamental articles of Furniture, such as *Chandeliers, Lamps, Candlesticks, Mantel Ornaments, &c.;* Frederick B. Merrill, Buffaloe, Erie county, New York, June 13.

Skeletons of chandeliers, candlesticks, &c. are to be made of wire, wood, &c., and these are to be suspended in saturated solutions of alum, or other permanent salts, which crystallizing upon the skeleton so formed, is to supply a cheap substitute for drops, and other ornaments of cut glass.

Ornaments made in this way, are familiar to most of our readers. The chemist has frequently exhibited them to illustrate the formation of crystals to his pupils. Ladies have decorated their mantels, and confectioners their windows, with baskets, columns, and colonnades, resplendent with the tints of the rainbow, by the reflection and refraction of natural and artificial light.

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52. For a *Fork, for Digging the Soil of Gardens, &c.* called a 'Prong Spade;' William H. Norton, Middletown, Middlesex county, Connecticut, June 15.

This fork is to have the general form of a spade; the number of its prongs may vary, but four is preferred. A length of about ten inches, a width of about one and an eighth inch, and an interval of about $\frac{7}{8}$, is also recommended. The fork is to be made of steel, and brought to a spring temper; the prongs may be made rather hollowing on the face, and are to be bevelled from the back, so as nearly to form sharp edges.

This instrument, it is said, may be used in digging with much greater facility than the spade, as it is lighter, and encounters less resistance; it answers the double purpose of the spade and the fork; is not clogged by a wet soil, and may be used around shrubbery and plants, without injury to their roots; it may also be used as a shovel. Such are the advantages which it offers, according to the opinion of the patentee.

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53. For an improvement in the *Mode of Representing the Notes in Music;* William C. Phillips, Lunenberg, Virginia, June 18.

The patentee proposes to substitute for the dots which represent the notes upon the lines and spaces in music, the first seven letters of the alphabet, using capitals, small letters, italics, &c. to designate the value of the different notes. Letters of the same kind may be employed for the semibreve and the minum, with the addition of the

same appendage which now distinguishes the value of those notes, that is, a straight line descending from the letter when used as a minum.

That the notation would be simplified by the adoption of this plan, is, we think, obvious. But in this, as in the reformation of the alphabet, there are two questions at least which present themselves for consideration; can the reformation be introduced? and if it can, will the advantages transcend the disadvantages? Our beautiful and simple system of reckoning in federal money, will fully exhibit the difficulty of introducing new notations, or modes of reckoning. Nearly forty years have elapsed since all the fiscal accounts of the government, and of our merchants, have been kept in this money, and yet at the present day nine-tenths of our monied transactions are in the currencies of the respective states, although it is universally confessed to be an evil, and one, the cure of which would not be attended by any inconvenience.

A new notation in music, like a new alphabet, would have to encounter obstacles incomparably greater than that of our federal money. The written language of music is a universal one, and every musician must be able to read Handel and Mozart, or he may at once determine to "hang up his fiddle." Instead therefore of giving facilities to the learner by a new mode of writing, you absolutely compel him to undertake a double task.

The moral difficulties which interfere with the adoption of such a plan, are, in our opinion, as really insuperable as those physical ones which are the stumbling-blocks of the devisers of ever-moving machines.

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54. For a mode of *Ascertaining the Weight of Goods, or other Loading, in Boats,* or other water craft; Thomas Cohoon, Troy, New York, June 18.

Tubes are to be fixed on the gunwale of the boat, or in any other convenient part. These tubes are to stand vertically, are to be open at both ends, and their lower ends dip into the water. Floats, with graduated stems, are used to ascertain the height of the water in these tubes; these stems having been once graduated by actually loading the boat by tons, or half tons, will ever after indicate the weight of the loading. The floats may be made of any buoyant material, as of cork, hollow balls of metal, &c., and when the load is unequally distributed, the measurement may be taken in different parts of the vessel.

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55. For a mode of *Manufacturing or Forming Hat Bodies of Wool, by Machinery;* Levi Van Hosen, Norwalk, Fairfield county, Connecticut, June 19.

The general principle upon which this machine acts, is similar to that of several others which have been patented. The wool is taken from the doffer of a common carding machine, and wound upon

cylinders with rounded ends, or upon cones, so as to form the bodies. The particular claim in this machine, is to the mode of vibrating the sheet of wool, as it winds upon the former, so as to cross the fibres, and cause them to felt well, and of forming from one to six bodies at the same time, according to the width of the carding machine.

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56. For an improvement in *Canal Passage Boats;* Jacob Bromwell, Cincinnati, Hamilton county, Ohio, June 23.

A moveable roof, forming an awning, is to be constructed above the ordinary roof of a canal boat; this roof is to be capable of sliding down, so as to coincide with the fixed roof, when the boat passes under bridges. To effect this, the standards, or stancheons, which support the moveable roof, pass into hollow columns, or boxes. Weights, passing over pulleys, serve as a counterpoise to the moveable roof, and suffice to sustain it when not pressed down; or the same effect, it is stated, may be produced by springs. There are two pieces of tough hard wood, hinged to the front edge of the moveable roof, and, at the other end, to the bows, or some forward part of the boat; these are to form inclined planes, which, when passing under bridges, are to press the moveable roof down.

The object of the invention, is, the accommodation of the passengers, who, under the protection of this roof, may view the country through which they pass, without annoyance from the sun or rain. They must *look out,* however, in passing bridges, or the roof may prove a "dead fall." It may be well to recollect the poor Frenchman, who, when the captain of a canal boat cried "look out," as they approached a bridge, nearly suffered decapitation by literally obeying the order.

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57. For a mode of *Cutting out Boots and Shoes,* by means of a scale, or graduated pattern; Samuel Marshall, Philadelphia, June 23.

The pattern used by Mr. Marshall, is usually made of copper, and bears a strong resemblance to that for which a patent was obtained by Mr. Thomas Howe, of Massachusetts, on the 18th of April, as noticed in our last number. It appears highly probable that both these gentlemen have adopted analogous modes of procedure, independently of each other.

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58. For a *Cooking Stove* for burning Lehigh, and other hard coal; Cornelius Schermerhorn, New York, June 23.

Judging from the drawing and description, we should think this stove well adapted to its purpose. At all events, it is distinctive in its character, the structure of the stove, and the management of the fire, differing essentially from every other which we have seen.

The body of the stove is a rectangular iron box, closing in front with folding doors. This box contains a sliding grate, or furnace. In the drawing accompanying the specification, the grate is repre-

sented in the form of the ordinary Lehigh coal grate, with open bars in front. The box in which the grate is contained, is in length and height just sufficient to receive it, but in depth, from front to back, about three times that of the grate. A bar, or rod, projects forward, by means of which the grate, which slides upon ledges, may be drawn forward, or pushed towards the back of the containing box. The top of the box, in front, is perforated to receive boilers, &c. under which the grate may be drawn, whilst at the same time roasting may be effected in front of it. The back half of the box is surmounted by an arched oven, formed of double plates, to allow a passage to the escape pipe. There are sliding dampers, and other appendages, which appear to be ingeniously contrived and likely to operate well, but which we shall not attempt to describe.

The claims are to "the sliding furnace acting directly on the boilers, and all parts of the oven; and likewise the ventilators, preventing a too intense heat upon the bottom of the oven plate; also the portable slide, or damper, and the construction of the double flue."

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59. For an improved *Churn;* Abner Murray, Athens, Bradford county, New York, June 27.

This churn is to stand vertically; its dasher consists of one flat board, revolving on gudgeons, and reaching each way, to within two or three inches of the sides of the churn. Stationary slats are fixed within the churn, extending from the bottom to the top; they are fastened by one edge to the staves, and are sufficiently wide to reach within half an inch of the dasher; of these slats there may be two, or more. The upper gudgeon of the dasher passes through the top of the churn, and has on it a bevelled wheel, which is turned by a second bevelled wheel, fixed upon a horizontal axis, and moved by a crank.

The claim is to the "placing from two to five slats, or breaks, perpendicularly, at equal distances apart, inside of the churn, to set between the joints of the staves, standing edgewise, towards the centre of the churn."

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60. For an improvement in manufacturing and *Ornamenting of Combs;* Ebenezer Mustin, Philadelphia, June 27.

This improvement in the *manufacturing* and ornamenting of combs, consists in drawing any device, or ornament, upon the tops of combs, with gold size, and the laying on of gold, silver, or other leaf, or bronze. This process is the same that is practised upon chairs, and an infinite variety of ornamented articles; the *invention,* or *discovery,* therefore, consists in doing that upon combs which has in itself no novelty whatever. The whole specification might have been comprised in the words, "I claim a patent for ornamenting combs by gilding." Query, is this "a new and useful improvement on any art, machine, manufacture, or composition of matter, not known or used before the application?"

61. For an improvement in the mode of *Making Cloth by Machinery;* Henry Raymond, New York, June 27.

There is in Mr. Raymond's specification, a very exact description of the machinery which he employs in manufacturing cloth by felting, without spinning or weaving. We have recently had occasion to notice some patents which have been issued for the same purpose, and have adverted to former attempts of the same kind. Besides the present claimant, it will be seen that patents bearing the same date, have been obtained by Mr. Van Hosen, of Connecticut, and Messrs. Peck and Taylor, of New York.

The revival of this plan for manufacturing cloth, has, we have no doubt, been suggested by the machines now so extensively used in the manufacture of hats, in which the wool is taken from the carding machine on to a conical former, for the purpose of felting.

The essential parts of Mr. Raymond's machine, are, a wool carding machine, and a roller fixed upon a carriage, which traverses in front of the doffing cylinder. In the machine described, the cylinder upon which the bat of wool is to be received, as it is delivered in a sheet from the carding machine, is five feet in length, and three feet in diameter. As the carriage which supports it traverses in front of the doffing cylinder, and in the direction of its axis, the wool alternately crosses the preceding layer. A second, and smaller cylinder, or roller, rests on the periphery of the large one, and, by its pressure, slightly consolidates the layers of wool, and prepares it for felting. A cylinder of this size will afford a piece of cloth of about five by nine feet, but this may be varied according to the size of the machinery. The particular mode in which the large cylinder is made to revolve, and its carriage to traverse, it is not thought necessary to describe.

The claim is to "the above method of forming cloth webbing, of wool, or of any other material which has felting properties, by the use of the carriage and two cylinders, made to perform the above mentioned motions."

It is stated, that "upon this plan of operation cloth may be made of any desirable length and width, and suitable for carpets, blankets, rugs, gentlemen's wear, and other purposes, in greater perfection, with more despatch, and less expense, than by any other method; and the machinery is easily kept in repair."

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62. For a machine for *Making Felt of Wool* without spinning or weaving; Levi Van Hosen, junr., Norwalk, Fairfield county, Connecticut, June 27.

Although the object of this patent is the same with the last, the manner of effecting it varies in several particulars. Instead of one carding machine, there are three, one of them of four feet, and two others of two feet in width each. The sheet of wool as it comes off the four foot machine, passes upon an endless cloth, which hangs down through the floor of the manufactory, into the apartment below, and extending in length about twelve feet. The wool from the

two narrower machines is in like manner received upon endless cloths, having their planes at right angles with that of the wider cloth. The wool passes below on to a frame called the felting machine, upon which the wider web is laid. This frame has a vibrating motion, for the purpose of carrying it backwards and forwards under the wool delivered from the narrower machines, causing their fibres to cross those from the wider machine at right angles. This it is made to do on both sides of it, until there is sufficient thickness to form the felt. Thus the wool from the four foot machine may be compared to the warp, and the others to the filling; the warp being in the centre, and the filling on each side of it. "The felt after it acquires sufficient thickness for use, is received between two cylinders about six inches in diameter, which are put in motion by gearing on the other end of the frame. The felt passes between two cloths, which revolve by the same gearing which draws the felt, and the first process of basoning is produced by cylinders which revolve and generate steam." [? How?]

"What I claim, is the mode of setting up the felt in the piece, and crossing the wool like warp and filling, directly at right angles, by laying the warp in the centre, and the filling on each side of the felt."

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63. For *Manufacturing of Cloth* without spinning and weaving, and by crossing the wool; Nehemiah Peck and Daniel Taylor, New York, June 29.

The machinery proposed to be used by Messrs Peck and Taylor, is essentially the same with that of Mr. Raymond, and their applications were, therefore, viewed as interfering. This was represented to the parties, between whom a compromise was consequently made; it being agreed between them that both patents should issue, the interest of each having been adjusted in a way which was mutually satisfactory.

Messrs. Peck and Taylor claim the combination of the machinery described by them, and its application to the crossing of the wool, either separate, or with cotton or hair, for the purpose of making blankets, table-spreads, and other kinds of cloth. Also, the principle of crossing the wool, cotton, or hair, by machinery; likewise, the use of one or more carding machines, placed in a row, or at right angles; and their mode of hardening and fulling the cloth, as described in their specification.

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64. For an improvement in the *Printing Press*, for which a patent was obtained on the 8th of February, 1819; John J. Wells, Hartford, Connecticut, June 29.

The press is one of those in which the power is obtained by causing a lever, acting horizontally, to operate upon two others, which form what is usually known under the name of the *toggle joint.* The improvement made is in the mode of connecting these moving parts.

65. For a *Power Windlass;* William Pennell, Brunswick, Cumberland county, Maine, June 29.

Two cog wheels, and two pinions, which act in the manner of the common double geared windlass for raising weights, constitute this machine; the axles upon which the pinions are formed, are turned by common cranks, or by handspikes.

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66. For an improvement in the construction of *Steam Boilers;* Francis Coffin and Charles C. K. Beach, Boston, Massachusetts, June 29.

(See specifications.)

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67. For a new and useful machine for *Fastening and Securing Window Shutters;* Truman Bartholomew, New York, June 30.

This *machine* consists of two latches, and two catches, one pair of them to fasten the shutter, when open, against the wall, the other to secure it to the sill when closed. A particular description we should deem superfluous, as the contrivance possesses no great novelty. It will, undoubtedly, answer the purpose equally well with fifty others, patented and unpatented, which have been offered to the public, and probably better than several of them.

Specifications of American Patents.

Description of an Improved Wheel with Revolving Paddles, applicable to the propelling of Ships and other floating bodies. Patented by Adolph Heilbronn, *New York, March* 16*th,* 1829.

(WITH A COPPER-PLATE.)

In the patent of Mr. Heilbronn, several different improvements in navigation are described and claimed; in the present article, we shall explain the first of them only, but shall hereafter present the others, having a plate prepared for that purpose.

These various inventions have been perfected in conjunction with a gentleman in England, where a patent has also been obtained for them.

The revolving motion given to these paddles, differs altogether from that which has been contrived with a view to their dipping into, and emerging from the water vertically. The paddles, or buckets, in Mr. Heilbronn's wheel, are each fixed upon an arm which radiates from the centre of the wheel, as may be distinctly seen by a reference to the engraving.

In a wheel so constructed, the paddles may be made to enter the water edgewise, and be turned, so as to act upon it at any point which may be preferred. The paddles which are out of the water, are all feathered, or turned edgewise, so as to experience but little

resistance from the wind, and to require a very shallow box or casing, to protect them on each side of the boat. A wheel of this description may be immersed in water to any depth which may be required; or it may be entirely under water, where the depth is sufficient; should such a mode of fixing it be thought adviseable, the progress of the boat will be but little impeded thereby.

One great advantage anticipated from these paddles, is the avoiding of those numerous and perpetual concussions produced by the striking of the water by the ordinary floats, which causes a continued, distressing, and very injurious tremulous motion. They enter by their edges, and are gradually brought into action.

The number of revolving paddles to be used, will be best determined by experiment.

Figure 1, plate 2, represents one of the said wheels of eight arms or paddles, as it appears when in a finished state, and as applied to the side of a vessel; and figure 2 is a view on a larger scale of the central part of the said wheel, as seen from the opposite side, or that nearest to the vessel, for the purpose of showing how the paddle-arms are held and supported in their places, and yet permitted to turn or feather at the proper instant, while the whole wheel turns round; and figure 3 is a section of the same part of the paddle-wheel, as is shown by figure 2, and likewise of the piece G G, which is called the wiper carriage, which is immoveably fixed to the side of the vessel, for the purpose of producing the turning or feathering of the paddles at the proper moment. In these several figures A A A A, is a circular disk or plate of cast-iron, having a rim or ring B B B, rising on one side to a sufficient height to give strength and solidity to the said circular plate, and also to take the brasses C C C, through which the paddle-arms or axes D D D D, are permitted to turn. The central block of metal E may be cast in one piece with the disk or plate, but will be better detached, and afterwards fixed to it by screw bolts, as shown in the section figure 3, because when detached, the brass sockets, or steps *a a a a*, for receiving the inner ends of the paddle-arms or axes, can be more accurately bored and fixed. The disk or plate A A A A, with its centre block E, forms the central part of the paddle-wheel, which must be firmly keyed, or otherwise fixed upon the main shaft F F, which derives its rotary motion from any power applied within the vessel, and this shaft also passes freely through the centre of the metal wiper carriage G, which is firmly and immoveably fixed to the side of the vessel, for the purpose of operating upon the wipers or projections *b b* of the paddle axes, in order to produce the turning or feathering of the paddles. To effect this, the outer face of the wiper carriage presents two annular surfaces, as seen at *c* and *d* in figure 4, (which is a front view of it,) and a part of one of them is cut away as at *e e*, to a greater or less extent, according to the period at which it may be desirable to make the paddles turn or feather. The wipers or projections on the axes of these paddles are projections of steel or other metal, crossing each other so as to project at right angles from the axes of the paddles, and as these wipers come into contact with one or other of the

annular surfaces *c* and *d*, figure 4, and also seen in figure 2, the several paddle axes will each make a quarter turn or revolution. Thus the five wipers *z z z z z*, figure 2, lie with their flat surfaces upon the annular surface *c* of the wiper carriages, but that surface is cut away between *e* and *e*, (as is more distinctly seen in figure 4,) and the inner annular surface *d* then presents itself, and acts upon the wipers *z z* to turn them round; consequently the inner wipers *y y y* will now assume the flat position, and will continue in it, until they are again brought by the motion of the wheel, into contact with the ends of the outer annular surface *c*. It will thus be seen, that by enlarging or contracting the opening *e e*, figure 4, and with it the inner annular surface *d*, that one, two, or more, of the paddles may be made to stand at right angles to all the rest, and thus that any number of paddles may be made to move through the air, and to enter into and come out of the water with their thin edges forward, while the remainder, or those that are under the water, will remain steadily in that position in which they are most effective for the purpose of propelling, as is distinctly shown by the manner in which the paddles are arranged round the wheel, as shown by figure 1. It will be necessary to employ springs to prevent the blow and concussion, which would otherwise take place between the wipers on the axes of the paddles, and the ends of the wiper carriage upon which they strike, and by which they are turned round; and the best application of such springs, is to use those of the spiral kind, of considerable strength, and to introduce them into round holes very nearly fitting them, and drilled in the ends of the wiper carriage which first comes into contact with the wipers. The spring being introduced into the hole, a cylinder of hard steel just fitting the hole is placed upon it, and there fixed by a pin driven through a chased mortise hole in the said cylinder, in such manner that the said cylinder can fall wholly into the said hole when pressed upon, but without such pressure, will project about half an inch or rather more out of the said hole; and as the said wheels are so fixed as to require cases to protect them, as in ordinary steam-boats, such cases may be formed of light iron work, covered over with slight iron bars, or with strong wire work, because such open work cases do not offer the same resistance to the wind and water as close boarded cases do; and moreover, they have the effect of much more effectually breaking the force of the waves when they drive against them. Bars or rods with points upon them are also fixed to the insides of such cases, causing the said points to come as nearly as possible to the paddles and paddle axes without touching them, for the purpose of clearing off any weeds that may attach to the paddles, and likewise to protect them from striking against any timber, ice, or other floating substances, by which the paddles of steam-boats are frequently broken or injured.

The claims of the inventor, in the paddle wheel and its appurtenances, are, First, to the frame work, or wheel, as above described, for holding the patent paddles. Secondly, the introduction of springs to act upon the wipers. Thirdly, the paddle box made of open wire-

work, net, or cross bars, with projecting pieces, or points, to clear the paddles.

Experiments are now in progress in New York, for testing the value of the foregoing machinery. The trials hitherto made have been attended with satisfactory results; but experience teaches us to suspend a final judgment until the thing is fairly tested, in a vessel of the ordinary size.

Description of a Revolving Boiler for Steam Engines, invented by Francois Coffin, *and* Charles C. K. Beach, *of Boston, Massachusetts. Patented June 29th,* 1829.

A cylinder of iron or copper, is made of such length and diameter as may be determined upon; a second cylinder of the same length, but two, or more, inches less in diameter, is placed within the first, and a hoop of metal inserted at each end, to fill the space between the two. This hoop is rivetted, and made steam-tight, and a space of one inch, or upwards, is, of course, left between the two cylinders. This space is to be kept full of water, for the supply of the revolving boiler, that is to be contained within the outer case, which the patentees denominate the heater.

The heater may vary in its form; it is intended sometimes to make it egg-shaped, and to increase the space at the upper part, so that in a transverse section it would be somewhat in the form of a new moon. A boiler of this kind may be constructed without being enclosed in brick work, and is particularly adapted to steam-boats.

Through the top of the heater, two, or more, perforations are made, for the passage of smoke and flame from the fuel. Cast-iron heads are made to close the circular ends of the heater, and in these there are man holes, and such other openings as may be necessary. A cylindrical boiler is placed within, and extends the whole length of the heater; this boiler is supported upon hollow gudgeons, which proceed from the centre of each of its heads, and pass through suitable openings in the iron plates which close the ends of the heater. Upon these gudgeons the boiler is made to revolve. For this purpose they rest, when the boiler is full, upon the openings in the heads of the heater; but as one of the ends is, to a certain extent, susceptible of being elevated and depressed, the opening in the head through which the gudgeon passes is lengthened upwards, the gudgeon, or rather the pipe which passes into it, resting upon an apparatus, to be presently described.

Under the boiler is a furnace, and ash pit, built up with brick work, in the manner of other cylindrical boilers.

By means of a force pump, the heater is kept constantly filled with water, and from this it passes into the boiler through one of the hollow gudgeons. Through the other gudgeon the steam escapes to supply the engine. One of these gudgeons is, we have said, capable of being elevated and depressed. This is effected by a lever with a

long and short arm, which extends horizontally over the boiler. The short arm is connected to the gudgeon of the boiler, which is capable of elevation; and upon the long arm is hung a weight, which is an exact counterpoise to the weight of the boiler, and the contained water, when sufficiently filled. When the quantity of water diminishes, the weight on the lever preponderates, and this, by a proper connexion with the force pump, increases the stroke of the latter, and consequently the supply of water.

Instead of the heater before described, it is proposed sometimes to surround the boiler with metal tubes, running longitudinally with it, having connecting pipes at their ends, to convert them into a continued tube, into one end of which the water is forced, whilst from the other it passes into the boiler, through its gudgeon, as from the heater. These tubes are kept in their places by resting on hollows in the cast-iron furnace heads, and are surrounded by the arched brick work of the furnace.

The boiler is made to revolve by the motion of the steam engine, a toothed wheel which carries it being secured by screws on to one of the gudgeons. By means of proper gearing, the rapidity of the revolution is placed under the command of the engineer.

"The heater is always full, but it is obvious that the boiler, continually revolving, requires but little water, say from $\frac{1}{20}$th to $\frac{1}{10}$th of its capacity, thus leaving almost the whole of it for steam-room.

"The boiler containing so little water, is heated in a few minutes, whereas, in the common boiler, the body of water is so great, that it requires a very long time to get up the steam, and at a great expense of fuel.

"The danger of bursting, in the common boiler, from being unequally heated, and from the great body of boiling water within, is justly considered imminent. The revolving boiler is always equally heated, and the volume of water, being comparatively nothing, the danger is proportionably decreased.

"What we claim as new, in the foregoing specification, as being of our inventions, are:

"1st. The revolving boiler, as entirely new and hitherto unknown; and we claim the exclusive use of it, with or without the heater, and with or without the pipes; it being, in either case, much superior to any known method of generating steam.

"2nd. The heater, which surrounds the boiler, and supplies it with boiling water.

"3d. The pipes answering the same purpose as the heater.

"4th. The manner of suspending the boiler at one end, by which contrivance it feeds itself."

Some account of various improvements in Rail-roads and Rail-road Carriages, invented by Isaac Knight, *of Baltimore, Maryland. Patented June* 11, 1829.

The specification accompanying this patent, is so extremely excursive in its views, so immethodical in its arrangement, and so indefinite in its claims, as to render an analysis of it extremely difficult. We have, therefore, taken it up, and given a short abstract of its contents, in the *order* in which they stand.

The proposed rails are to be of wood, about 2½ inches thick, and ten inches deep; these are to be covered with bars of wrought iron of the exact width of the thickness of the rails; the wheels of the carriages are to have double flanches.

In passing over vallies, long posts of wood may be used to receive the rails; pillars of stone, or chairs of cast-iron, may be employed when the depth is not too great. The joints where the rails are let into the posts, may be secured by coverings of tin, sheet lead, &c. The pillars must be framed together by cross-ties and braces, where the elevation is considerable. The horse path is to be formed of plank, where the depth is too great to fill with stone or gravel.

The two flanches upon the wheels, it is calculated, will tend to keep the rails from losing their parallelism. It will be evident, however, that if they effect this object, it must be at the expense of great friction, yet these flanches are depended upon to prevent the necessity of cross-ties.

It is said, that case-hardened friction wheels should be used, and that they should rest upon the main axle of the travelling wheels, which should likewise be case-hardened. A particular mode of fixing the framing for these is recommended.

It is proposed to fix seats for passengers along the sides of the carriage, which seats may project over the wheels. There is also to be a dining table, and other accommodations, such as stoves, a kitchen, glass windows, stairs, &c. which are all proposed as parts of the establishment.

The mode proposed of adapting the carriages to curved roads, is very similar to that of Mr. Howard, and also to one included by Mr. Knight in a former patent.

Masts and sails may occasionally be used, to take advantage of the wind, when fair. By means of ropes, or endless chains, passing over pulleys, these carriages, it is said, may be made to draw others against the wind.

There is here a general claim to the foregoing principles and combinations, and a specific one to the manner of placing the wooden rails upon the tops of the posts. The particular form of these wooden rails. The application of the double flanched wheel running upon flat bars of iron. The mode of covering the posts to protect them from the weather. The mode of fixing the friction wheels, and using smaller ones to prevent lateral friction.

The patentee intends also to protect the posts where they enter

the ground, by filling round them with small stones; to pave round them with flat stones; and to cover the whole with tar and sand.

The mode of bridging described, is next claimed; also a cheap plan of branch rail-roads; also a mode of embarking wagons, and landing them from boats, by means of a windlass; also the invention of a *shifting carriage*, to run on lateral, or branch roads, upon which shifting carriage the loaded rail-road carriage is to be conveyed; to a double inclined plane, or rail-way, running on two sets of rails, one over the other, for the purpose of removing earth, &c. to small distances. Also a mode of connecting ropes and pulleys for one carriage to descend, and another to ascend, an inclined plane. To a double rail-way, one above the other; and to a mode of travelling both ways on a single track. To the covering the wood under the rail, and at the joints, with sheet metal, and bending it down to prevent injury from wet. There are likewise several intervening claims which we have omitted, in order to shorten this article; but the next is to a whole newly contrived carriage, which has been figured and described in many of our public papers; the following may give some idea of it.

A horse is to be placed upon a moveable endless floor revolving upon rollers, and these are to give motion to the main wheels of the carriage; they may be so geared together, that if the horse travels at the rate of two miles per hour, the carriage may go ten. This is particularly described.

After this comes another mode of protecting the posts, which is claimed. The post is to be bored longitudinally, and the hole filled with oil, or salt, or a mixture of both, and plugged up. The outside is then to be painted with white lead, to be covered with sheathing paper, or cloth, saturated with proper materials, or to be covered with sheet metal.

There are in the above so many items, that we cannot attempt to animadvert upon them; the patentee has made a complete rail-road and rail-road carriage analecta: it is, however, fairly to be apprehended, that a number of his claims will be disputed by other inventors; and indeed this has been already done. Some of the claims appear to be for intended improvements, which are now patented in anticipation, and several others, we suspect, will not fulfil the averment that they are *new* and useful. Admitting, however, that every thing claimed is new, useful, and original, the question may fairly be asked, whether there is a sufficient connexion in all the things claimed, to make them properly the subject of a single patent. Half a dozen new machines, or improvements upon half a dozen old ones, can scarcely be included under the terms a "new and useful art, machine, manufacture, or composition of matter."

Specification of a patent for an "Improved Rope-maker." Granted to STEPHEN HILLS, 2nd, *Glastonbury, Connecticut, June* 11, 1829.

THE size of the machine may be varied, according to the bigness of the rope, rigging, or twine, to be made. That for common rope,

or rigging, is about six feet square, on a frame. On one end are three spindles standing perpendicularly, with spools and flyers attached to them, and driven by a belt, or gear. On the opposite side is one spindle standing also upright, with spool and flyers driven by a belt or gear, cross banded, or contrariwise from the three first mentioned spindles; this takes up, with a heart motion, the rope, or twine, as fast as laid. All the spindles are moved by a horizontal wheel in the centre of the machine, and may be turned by hand, horse, or water power. Three threads pass between two rollers placed above the wheel, from the three first mentioned spindles, and pass from thence to the one spindle mentioned last as standing alone.

The great advantage of this machine, is, that any kind of rigging can be made in a room sixteen feet square; and this supersedes the necessity of rope-walks; it also makes the material better and faster than the common mode, and it consequently can be afforded at a cheaper rate.

What I claim as new, and as my own invention, and for which I demand an exclusive privilege, is the whole machine as applicable to the above purposes. STEPHEN HILLS, 2nd.

Specification of a patent for an Iron Mill, for grinding various articles. Granted to JOHN W. POST, *of Washington, D. C. and* CALVIN POST, *of Springport, Cayuga County, New York, April* 11*th.*

THE grinding part of this instrument is made either of wrought or cast iron, or of steel; it consists of two parts, one of which moves within the other. The outer part may consist of one solid piece, or of sections, forming a conical tube. The inner part corresponds with the outer. On the grinding surfaces of each are either spiral, perpendicular or cross threads, projections, or furrows, increasing in number, and decreasing in depth, as they approach the vent of the mill. The threads on each may run parallel, being of any inclination required. The inner grinder moves, and the outer one remains stationary, it being unnecessary that more than one of them should move, although both of them may be made to move, if thought necessary. The lower part of the inner grinder terminates in a pivot, or point, which stands in a cup on a piece of timber, and is raised and lowered with the timber, to set the mill for grinding coarser or finer, by means of screw-bolts and nuts; the bolts passing through the timber which supports the outer grinder.

The upper part of the inner grinder terminates in a shaft, or gudgeon, on which is fixed a long pinion capable of rising and falling with the grinder, from three to eight inches, and still remaining in mash with the driving wheel.

The leading principle of this improvement consists in having the least possible diameter of the grinders at the upper or feeding end; great length and as little increase of diameter at the bottom, or vent, as will merely admit of setting the mill for grinding coarser, or finer.

For a hand mill, the upper, or feeding end, is required to be little more than one inch diameter, and the lower end, or vent, two inches, being two, or more, feet in length, and uniformly tapering from the top to the bottom. By this form and construction the greatest possible mechanical leverage and power is obtained; the mill may move with great velocity, the grain, or article, being introduced as nearly as possible at the fulcrum, or centre of the shaft or grinders, and continuing near the centre until it is discharged, almost any resistance is easily overcome.

For grinding corn with the cobs, bark, apples, or any other coarse article, the upper part of the outer grinder has a funnel top, which contracts gradually in its capacity for a short distance; after which it is continued with a small and uniform increase of diameter, as described in the mill for grain, and other small articles; the whole being three feet in length.

In grinding corn with the cobs, bark, or other coarse articles, the mill may first be set coarse, and after the corn is shelled from the cob, and the cob broken, or the article rendered finer, the mill may be set finer, and the grain, or article, passed through a second time.

For the hand mill, the pinion, which has already been mentioned, may have from ten to twenty cogs; and the driving wheel, which is a faced cog-wheel, may have from fifty to a hundred cogs; to which may be connected, either on the same piece, or on the same shaft, a fly-wheel, all moved by a crank.

For the horse mill, a whorl, instead of the pinion, may be used, receiving a strap from a large horizontal wheel upon a vertical shaft.

Either of the forms of the grinder may be used for breaking grain, or other articles, preparatory for the common flour mill, to which it may be either mediately or immediately connected, as circumstances may require.

Mills may be constructed upon this principle, consisting in part or altogether of stone. The lower part may be stone, so as to make flour of the article ground.

What we claim as new, and as our own invention or discovery, in the above described mill, and for the use of which we ask an exclusive privilege, are, the grinders, as above described, and the mode of regulating the mill both for hand and other power.

John W. Post.
Calvin Post.

FRANKLIN INSTITUTE.

The twenty-second Quarterly Meeting of the Franklin Institute of the state of Pennsylvania, for the promotion of the mechanic arts, was held at their hall on Thursday evening, the 16th July, 1829.

Thomas Fletcher, Esq. Vice President, in the chair, and Wm. Hamilton, was appointed Secretary pro tem.

The minutes of the last quarterly meeting, and also of the special meeting, were read and approved.

The chairman of the committee of investigation on the subject of water wheels, reported that the committee still continued to receive subscriptions towards defraying the expenses of the experiments; the amount fixed by the committee as necessary to be raised previous to commencing the operations, is now almost made up; the committee had hoped that the sum would have been received at an earlier date, but that has been prevented, entirely by the general depression of business among that class of citizens who are most immediately interested in the results of the experiments. The committee now believe that such an amount will shortly be subscribed as will justify them in making a commencement, and as it is of the utmost importance to extend their inquiries as far as possible, they hope the members of the Institute and others interested, will still continue to exert their influence to increase the amount of the subscriptions.

The quarterly report of the board of managers was read and accepted.

THOMAS FLETCHER, *Vice President.*

WILLIAM HAMILTON, *Secretary pro tem.*

The Twenty-Second Quarterly Report of the Managers of the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts.

THE board of managers present a report of their proceedings since the last quarterly meeting of the society, in accordance with the regulations and laws of the Institution.

In addition to the regular courses of lectures on chemistry and mechanics, to be delivered during the ensuing season, arrangements are now making by the committee of instruction, for the delivery, during the whole period allotted, of volunteer lectures, varied in their character, and of manifest utility.

The board would respectfully call the attention of mechanics and others to the subject of the delivery of volunteer lectures. They are the sources from which much good will flow, a large portion of valuable and interesting information be diffused, and thus serve in a great degree to keep alive the interest in, and extend the influence of, the Institute.

At the close of the present quarter of the High School, the course of instruction originally contemplated in that department, will have been completed. Since its organization, and during the whole term of three years, the board have been gratified with the flattering reports which have been received from the committee on instruction. It has received an unusually large share of the public patronage, and it has been instrumental in an eminent degree in diffusing the blessings of education, and in elevating the character and standard of instruction in the community, more especially in the introduction of a well digested and more complete system of text books than have heretofore been used in the schools in this city. The school will be continued in the Hall of the Institute, under the direction of the present principal, W. R. Johnson, A. M., assisted in the several branches by instructers of acknowledged reputation.

The board of managers would beg leave also to report, that a special committee has been appointed to make the necessary arrangements for carrying into effect the resolution of March 12th, 1829, in relation to the very interesting and important subject of ascertaining "the value of water as a moving power, and the relative effects produced by it on water wheels of different constructions."

The committee have been zealously endeavouring to raise the sum required to carry on the experiments contemplated, and have succeeded in obtaining a large proportion of it. The board rely with great confidence upon the assistance and exertions of the mechanics and manufacturers of the United States, to aid them in the investigation of a subject so valuable and important in the results to be produced, not only to themselves, but to the country generally.

Agreeably to a resolution passed at the last quarterly meeting, monthly meetings of the Institute have been regularly held on the fourth Thursday of each month, upon the plan described in the last quarterly report. It is believed that the results anticipated, have been produced by the adoption of this popular measure. Subjects of interest and practical utility have been presented and discussed, the library of the Institute has received considerable and important additions, the cabinet of minerals has been enlarged by donations presented at these meetings, and the board view their continuance as calculated to promote the object and interest of the Institute, and recommend the attention of the members to them.

By a resolution of the board, it was decided that the next exhibition should be held in the year 1830. This measure was adopted after mature deliberation; and it is believed that exhibitions held every two years, will excite more interest, and will be productive of more advantage to the arts and manufactures than annual ones. The committee on premiums and exhibitions are actively engaged in making arrangements for an exhibition at that time, which it is expected will not be inferior to any of those heretofore held, and which will exhibit the state and progress of the mechanic arts in our country.

Henry Horn, *Chairman.*

William Hamilton, *Actuary.*

Monthly Meetings.

In the twenty-first quarterly report of the managers of the Franklin Institute, (p. 291, vol. 3,) was given the plan of monthly meetings of the members, for the reading of papers, and the discussion of questions connected with the objects of the Institution. Several of these meetings have been held, and should they be continued with the spirit which has attended their commencement, they cannot fail of producing the most beneficial results.

The paper in the last number, on the subject of "Friction, and the Power of Heavy Bodies in Motion," emanated from that source, and we anticipate the reception of a sufficient number to occupy a

separate portion of the Journal every month. It is generally understood that an editor is not responsible for the opinions advocated by his correspondents; nor is it to be considered as his duty to undertake the invidious office of censor, although it is his right, at all times, to express his opinion. In discussions of the nature of those of which we are now speaking, it will be proper to allow an unusual latitude, as in such a case "error of opinion may be" advantageously "tolerated, whilst reason is left free to combat it."

For ourselves, we shall always prefer those papers which are upon practical subjects, as we consider one experimental truth to be of more value than a thousand ingenious theories; and these truths many of the gentlemen concerned are eminently qualified to make known. We say not this to damp the ardour of those who are anxious to inquire into *causes*, and should regret exceedingly to learn that our remarks had had the effect of suppressing the ingenious speculations of those who are seeking "admission behind the scenes."

Observations on the Hardening of Steel. By RUFUS TYLER, Mechanician, *Philadelphia.*

TO THE FRANKLIN INSTITUTE.

The following remarks on the subject of hardening steel, are offered to the Institute as the result of much experience in the regular course of my business, and of essays suggested by some peculiarity, accidentally noticed, and made for my own satisfaction. It is, perhaps, to be regretted, that I have not had leisure to repeat them with a view to greater accuracy of detail; by some, however, this may be deemed a favourable circumstance, as they are not fortified by any array of numbers, or formulæ, and may, therefore, be the more readily discussed, corrected, and amended, for which I am fully aware my best endeavours leave ample room.

The peculiar kind of hardening of which steel is susceptible, depends upon two conditions: first, *a sufficient degree of heat*, (somewhat above the lowest red,) which may be termed the hardening heat; and second, *sudden cooling*. A deficiency of only a few degrees of heat, or an excess of two or three seconds of time, beyond certain limits, will *entirely* defeat the operation.

The usual method of hardening steel for common purposes, is to heat it to the proper degree, (the lower the better, provided it be not so low as entirely to fail to harden,) and then to plunge it suddenly into cold water. When it is requisite to protect the surface from the corroding effects of the atmospheric air, as in engravings, dies of delicate workmanship, &c. it should be imbedded in fine charcoal powder, previously heated to redness, in an iron box, to drive off the evaporable matter, and when sufficiently heated, the piece must be removed to the cooling liquid with as little exposure to the air as possible. If the contents of the box be thrown, with the steel, into oil, so as completely to exclude the air, it will preserve its polish, and brightness, unchanged.

All articles of steel are more or less liable to become warped, by rapid cooling, from the unequal contraction of the parts, and many, from the same cause, require the greatest dexterity and skill, to prevent them from breaking in pieces during the operation.

Whenever, therefore, the nature of the case admits the use of oil, as a cooling medium, it is safer than water, being much less rapid in its operation. It is obvious, however, that as large masses of steel can with difficulty be cooled, even in water, within the hardening limit of time, only small articles, such as springs, thin blades, &c. can be hardened, at all, in oil. It is sometimes pretended that oil imparts a degree of toughness to steel hardened in it, just as it would to a bit of horn, or leather, by penetrating its pores; and I believe the patent obtained for the use of it, in hardening a certain *celebrated patent oil-hardened-spring truss*, was grounded upon such a supposition.

The danger of breaking increases with the *thickness* of the piece, whatever may be its form; and that form is least liable to break, in which there is the greatest freedom of motion, or in which a simultaneous contraction can be effected in all the parts.

In hardening a roller, say two or three inches in diameter, and about the same in length, the first tendency of the contraction of the surface is to separate it. But this strain being equally divided around the circumference, and the metal being in a yielding state, the only effect in general, is, to enlarge the surface beyond its original dimensions. The surface thus enlarged, immediately becomes hard and fixed; so that the subsequent cooling of the centre, reverses the strain upon the surface, tending to compress or shorten it, and that, to such a degree, that a segment is often thrown off with great violence, or, when the outer portion has sufficient strength to resist the contracting force of the centre, that portion in its turn tends to separate, being prevented by the outer part, (to which it adheres) from returning to its original dimensions. In this case, a separation at the centre is inevitable, unless a part of the heat be allowed to remain, until the surface be relaxed by tempering, after which it may be suffered to cool. When a rent commences at the centre, the parts generally separate with such force, as to sunder the mass, accompanied by a loud report.

It sometimes happens in the breaking of dies, rollers, &c. (in which the tempering has been omitted) that the effect does not take place until several hours, and even days, after they have been hardened.

Steel is allowed by authors to expand about $\frac{1}{8}$th of an inch to the foot, in heating to the hardening point, and to contract, on cooling, about $\frac{2}{3}$ds of what it had been expanded, provided the hardening effect takes place; otherwise it returns nearly to its original size. Accordingly, I have been in the habit of making allowance for this enlargement, which is generally found to take place, in a greater or less degree, and for many years held the opinion that it was a necessary consequence of hardening steel, and that this effect *ought* to take place, just in proportion to the degree of hardness produced.

With this doctrine, however, facts are at variance, and I believe, that the circumstance, above alluded to, as the cause of breaking,

may also explain most satisfactorily, the phenomenon in question, (to wit) that of hardening the exterior, before it can possibly be permitted to contract to its proper size, because of the expanded mass within.

I have found in a number of cases of thin hollow cylinders, or flattened rings, where there was the best chance of thorough, and almost instantaneous cooling, and, of course, of producing the greatest degree of hardness, that no enlargement was perceptible.

Particular care should be observed, in the act of cooling, not to suffer any intermission, in any part, as is often done by moving the piece backward and forward, too briskly, in the water, alternately cooling, and exposing to a vacuum, the opposite sides; for a part thus exposed, after moving rapidly against the current, until fairly hardened, might be let down, or tempered, as it is called, by the heat rushing from the centre, toward the side exposed to the vacuum, without being sufficiently re-heated to prepare it for hardening at the return of the current of water. In this way, soft places are often produced, which will erroneously be attributed to uneven steel, want of sufficient heat, &c.

By dipping the end of a small bar, (heated to several inches in length,) and keeping it quite still, until it is hardened nearly to the surface of the water, (which should be very cold,) and then raising it quickly, an eighth of an inch, or more, according to the size of the bar, a portion of what was hardened, will be softened by the heated part above;—as soon as this is perceived, let the bar be again sunk into the water, to where it remains of a hardening heat, which will be perhaps half of an inch lower than before, another portion of about $\frac{3}{8}$ths of an inch will thus be hardened; let the bar be again withdrawn a small distance, as before, repeating the operation, until there no longer remains sufficient heat in the bar for hardening; the result will be, a number of successive hard and soft rings.

While testing the strength of different kinds of steel, by repeatedly hardening each kind, until a fracture should take place, I was somewhat surprised to find the pieces, which were small, (such for example, as were an inch square, and $\frac{3}{8}$, or $\frac{1}{2}$ an inch thick,) considerably swollen, after three or four times hardening, and that every hardening increased their convexity, until they actually burst the surface, in the middle of one of the faces. Repeating the experiment, with a piece prepared perfectly flat, I found the first, second, third, and fourth time, of hardening each, to produce a small additional elevation of the surface. On the fourth attempt, the piece cracked.

I have seen a thin piece of steel very beautifully hardened, by chilling in its passage through a rolling mill; this piece afterwards exhibited in its fracture an exceedingly fine grain, a probable consequence of its being hardened under immense pressure.

Small drills, and other articles of the thickness of a small needle, may be cooled, with sufficient rapidity to become hard, by moving them briskly through the air.

Water, to be active, in cooling, should be perfectly free from soap,

—a small portion of that substance, will cause the time of cooling to be extended beyond the hardening limit, especially if the piece of steel be not very small.

The grain of steel, though finer when hard than when soft, becomes still finer, the lower the temper be drawn, until about a medium between hard and soft, when the fineness begins to decrease.

Cast-iron is capable of being hardened in the same manner as steel, except the kind which is already hardened at the time of casting. This kind possesses a superior degree of hardness, which differs materially from that obtained in the manner of hardening steel. It takes place in passing from the fluid to the solid state, and can only be changed by re-melting. As soon as time will permit, I intend offering some remarks on hard and soft cast-iron.

The most satisfactory theory of hardening steel, which also applies to cast-iron, is one suggested by Mr. William Mason, of this place. He supposes, that at the hardening heat, the component parts of steel exist in a state of perfect chemical union, and that if time be allowed in cooling, that union is dissolved, or changed to a simple mechanical mixture. This he conceives to be supported by the following experiment: melt together certain proportions of zinc and quicksilver, and pour one part of the amalgam into water, and the other into a wooden or paper mould; that which is poured into water being suddenly chilled, retains its chemical union, and becomes of the consistence of paste; the other separates, the zinc forming a solid cellular body, holding the quicksilver in very minute globules, in its interstices.

Very respectfully,

RUFUS TYLER.

Report of the Committee on Inventions, on WINAN's *Rail-way Carriage, referred to them by the Franklin Institute, at their monthly meeting for discussion of Mechanic and Scientific Questions, held April* 23, 1829, *in compliance with the request of* JOHN L. SULLIVAN, Esq.

The committee on inventions, to whom was referred the consideration of Winan's Rail-road Car, beg leave to report:—

THAT they have attentively considered the subject assigned to them, both with reference to the model before them, and to the description contained in the Journal of the Institute. They have, likewise, duly weighed the remarks of Mr. Sullivan, contained in a letter which accompanied the model, and which invited the closest scrutiny into the merits and defects of the principles of construction, and of the mode in which it is proposed to apply them to practice.

The resistances to be overcome in drawing a load over a common turnpike, or other road, arise from several causes; *first*, from the inequalities of the road itself, which allow the wheels to sink at one moment into cavities, and require them, and of course the load also, at another, to rise over prominences. *Secondly*, from the *friction*

of the axles in the naves of their wheels. *Third*, from the adhesion of the wheels to the materials of the road. *Fourth*, from the air in which the vehicle and all connected with it must ever be placed. To these causes of resistance we may add that of the inertia of the carriage and its load when commencing its motion, and finally, the inclination of the plane of the road, which will be in concurrence with, or in opposition to, the above mentioned causes, according as the carriage is ascending or descending, and of course, on a horizontal plane, is equal to zero. The primary object of all rail-roads, is, to conquer the first mentioned cause of resistance, namely, the inequalities of surface. To do this completely, the materials composing the rails, and the wheels which pass over them, must be *perfectly hard, smooth, inflexible, and free from the most minute particles of foreign matter.* If this were practically, as well as theoretically, characteristic of the rail-way, there would be no question about the amount of the second resistance, because the wheels, instead of turning on their axles, would then slide on the rails without revolving at all, as they are sometimes observed to do upon very smooth ice, and this, too, however small, might be the friction at the naves of the wheels, because the friction at the periphery would be still less, that is, absolutely *nothing*. The car would, in fact, become a sledge. But since the imperfection of materials, and the unavoidable inaccuracy of all structures formed by human art, forbid us to expect such a rail-way will ever exist, it becomes necessary to compute the amount of the second resistance, and, if possible, to devise means to reduce or to overcome it. The friction is *reduced* by making the nave and its axle as smooth as possible, by forming the two of different metals, by reducing the diameter of the axle as far as may be consistent with proper strength, and, finally, by the lubrication of the rubbing surfaces with such oily substances as are found effectual for this purpose. By these expedients, and by duly defending the interior of the naves from dust and from water, it is found that in practice the friction due to the axles may be reduced to about $\frac{1}{175}$ of the load.

With this reduction the horse may, without difficulty, draw a load of 8 or 9 tons over a perfectly level rail-way. With the same reduction an inclination of 30 $\frac{6}{35}$ feet per mile would, on a descending plane, be sufficient to overcome the friction and cause the car to descend by its own gravity. The irregularities of the rails and the slight obstructions from foreign matter, would be the same in all cases, and increase the necessary inclination. But in addition to the reduction of friction by the means already mentioned, there may be an application of the mechanical powers to *overcome* the remaining resistance, wherever the purpose to be accomplished will warrant an additional expense in the construction of the car; and where the additional machinery will not, on account either of its weight or complication, prove more detrimental than useful.

One of the most obvious expedients to augment the power of the wheel to overcome friction, would be, to increase its diameter, while the diameter of the axle remained constant, because as the friction

is proportionate to the weight, it would, for a given load, remain the same on an axis of given size and materials, however high the wheel should be on which that load might rest. But if the radius of the wheel be increased, the length of the arm of lever which overcomes this constant resistance is proportionally increased. Those who prefer the principle of virtual velocities for explaining mechanical powers, may consider, that with a wheel of double diameter, the load will be conveyed over a double space on the rail, while the force applied is overcoming that amount of friction which results from a single revolution of the wheel on its axle. This mode of overcoming friction has, however, the disadvantage of carrying the axles too high, and of exposing them to the injurious effects of a powerful lateral pressure when the two rails are not precisely of the same height. The changes of form in the wheel itself, would likewise require attention when its height should be greatly augmented. But it is not necessary to dwell on the defects of the high wheeled carriage. The committee have only referred to it as one of the expedients by which it has been attempted to overcome, in part, the friction on the axle.

The description of Winans' rail-road carriage, contained in the Journal of the Institute for April last, is so full as to require but little explanation from your committee. The mode of overcoming the friction of the axle, by causing the ends of it to revolve within the rims of friction wheels whose axes are below that of the travelling wheels, is certainly a very ingenious device.

It is not perceived by your committee, that the mere circumstance that the first and second orders of the lever are combined in the forms of the wheels of this carriage, is of any peculiar advantage in overcoming friction, since the principle of action and amount of power gained by the two orders is precisely the same. All the superiority which this circumstance imparts to the car before us, arises, therefore, from the convenient arrangement of the parts. It is a decided advantage in point of firmness and compactness of structure, that the friction wheels require no additional fixtures with which to attach them to the load frame, except such as constitute in fact a part of that frame itself.

The liability of common rail-way carriages to heat the gudgeons when moving with great speed, is a practical difficulty, which appears to be entirely removed by transferring the rubbing surface from the axes of the *primary* to those of the *secondary* wheels. The latter will always move so slowly as to preclude the idea of much increase of temperature from friction.

It will be observed, that the load now rests on eight bearings instead of four, the number found in every four-wheel carriage of the simplest construction. This allows the gudgeons of the *secondary* wheels to be less in diameter to support a given load, than those of the *primary*. A single revolution of the *secondary* wheel, will, therefore, present a less number of rubbing points to any part of the bearing, than would a revolution of the primary wheel, whose axis is of double diameter to that of the former. And the leverage is greater where the diameter of the gudgeon is less, so that if the strength and

other properties of materials allowed a very great diminution of the axle, the smaller it could be made, the better.

The friction is, doubtless, as stated in the description above referred to, nearly proportional to the weight; but when the weight is constant, and the motion of the rubbing surfaces uniform for each case, the *sum of all the resistances* due to friction is proportional to the number of units of rubbing surface brought into contact during a given time. If this be true, it is of great importance to form the pivots of the secondary wheels in such a manner as to rub on their bearings through the least possible space, while the carriage passes over the greatest possible space on the road.

The model performs in a manner sufficiently decisive of the advantage which the principle of its construction has over that of the simple car in overcoming friction; but your committee would hesitate to receive the performance of this model as a certain indication of what may be expected from the machine of full size on a common rail-way.

Nothing but actual experiment on a large scale will fully develop the precise amount of advantage of a machine of this nature, because it is not possible to foresee all the circumstances which will attend its construction and use. If confined to a straight, level, road, there can be no doubt that the power of the mover would be greatly increased by the addition of friction wheels. The same may be said where the carriage is employed solely in transporting loads *down* an inclined plane. But in conveying loads *up* an inclined plane, the additional weight arising from the friction wheels would increase the gravitating power of the load. With the common cars, as perfected in England, the horse could draw up a plane inclined $30\frac{6}{35}$ feet per mile, only one-half as much as he could draw on a level; because, as before stated, the effect of gravity would there be just equal to friction, computing the latter at $\frac{1}{175}$ of the load. Now, if the car of Mr. Winans enables the horse to draw 56 tons on a perfectly smooth and level road, where friction only is to be considered, it would require the strength of about $7\frac{1}{2}$ horses to convey the same load up the inclined plane just mentioned.

This would seem to decide in favour of confining the use of this car, if adopted at all, to level roads, or to those on which the transportation is descending, or at least to those on which stationary power is employed in surmounting elevations.

As the invention has been presented with a request that its merits and defects may be closely scrutinized, your committee have thought proper to present some of those points in which it seems likely that this carriage may be found inconvenient, or defective, in its practical application.

The first of these arises from the shortness of the axes of the secondary wheels, compared with the diameters of those wheels themselves, by which they will be liable to act as bent levers, and twist the side pieces of the frames out of their natural positions, or to wear, unequally, the two bearings of those axes.

Secondly, the latter effect will, it should seem, be increased by

the swagging of the load from side to side, in consequence of the arrangement by which the ends of the axes of the primary wheels act against the flanches of the secondary. Now they always act *outward*, and on one wheel at a time for each axis; consequently, there can be no restoring tendency, by which, when a friction wheel is pushed out of its vertical position, or its inner bearing is worn more than the other, the evil will be likely to be corrected.

Third. The imperfection of castings and other workmanship, may possibly allow the friction wheels to be worn in one or more places on the inside of each rim, to such a degree, as to allow the gudgeon to turn in the hollow part, as in a common bearing, and thus to prevent the secondary wheel from revolving. Should this be the case, the friction would, for that gudgeon, be reduced to that of the simple car.

Fourth. The friction wheels must be made heavier than if the pressure of the primary axles were applied to the *outside* of their rims, because, in the latter case, the arched form of the part to which the pressure is applied, would conspire with the cohesion of materials, to prevent the fracture of the rim, but the cohesion of parts must alone sustain the pressure in the case of the car at present under consideration.

Finally, as the axes of the primary wheels do not constantly preserve their parallelism with those of the secondary, the gudgeons of the former may be irregularly worn, in consequence of the obliquity which they may assume to the cylindrical surface of the interior of the friction wheel, and the same circumstance also allowing the whole pressure of a gudgeon to be occasionally brought upon the edge of the rim of a friction wheel, this part must be made strong enough to sustain the whole weight.

In conclusion, your committee would express a wish to see a carriage on this construction of full size put into operation, believing, that on levels and gradual descents, at least, it may be found eminently serviceable, and not doubting, that the same ingenuity which devised the construction, would supply the defects which we have pointed out, should they prove to exist, or any others which experience might demonstrate to belong to the peculiar construction now exhibited.

All which is respectfully submitted.

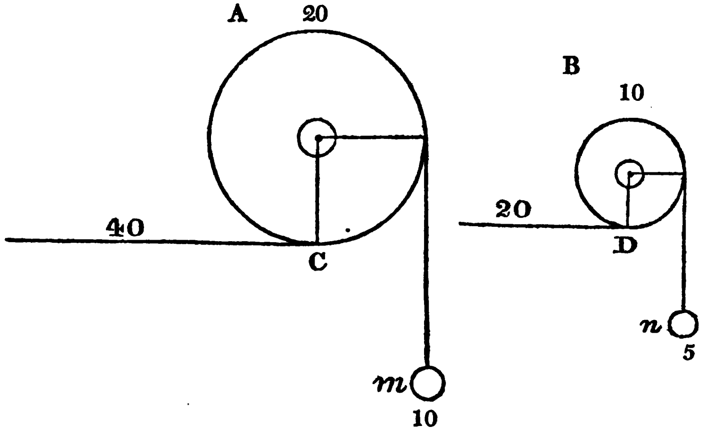
FOR THE FRANKLIN INSTITUTE.

On the force of Bodies in Motion, intended as an answer to some remarks on that subject, in the last number of this Journal.

Proposition 1*st.* If a double velocity in the quantity of water gives a double force, then it will raise, when applied to mill wheels, double the weight, to double the height, in the same time.

Suppose the diameters of the wheels A and B, to be as 2 to 1, and the same quantity of water to strike their circumferences in the same time, the large wheel with a velocity 40, and the small one with a velocity 20. Suppose also that the circumference of the large

wheel moves with a velocity 20, and that of the small wheel with a velocity 10; then will the water strike the large wheel with a velocity 20, and the small wheel with the velocity 10. Suppose now the forces to be as the velocities, there will be a double force applied to the circumference of the large wheel; consequently it will balance a weight *m*, double the weight *n*; but the weight *m* being hung at the circumference of the large wheel, will move upwards with a velocity 20, and the weight *n* with a velocity 10; therefore, a double weight is raised to a double distance in the same time.



Proposition 2nd. If a double velocity in the same quantity of water gives a quadruple force, then it will raise, when applied to mill wheels, four times the weight, to double the height, in the same time.

For in the above construction, according to the latter supposition, the circumference of the wheel at C, would be pressed with a force four times as great as the circumference of the wheel at D, and therefore, the weight at *m*, must be four times as great as the weight at *n*, and the velocity at *m*, is twice as great as the velocity at *n*; therefore, four times the weight will be raised to double the height in the same time.

The demonstrations of these two propositions, may serve as an answer to a very ingenious paper, which appeared in the Journal of the Institute for August last, in which the author endeavours to prove, that the forces of bodies in motion are as the squares of their velocities.

For it being known by experiment, that the effect of undershot wheels is conformable to the first proposition demonstrated above, and not to the second, it follows, that the first supposition is the true one, and not the second.

The following experiment, which is laid down in *the books*, I consider as direct proof, that the momentum of bodies is as their velocity, and not as the square of their velocity, as the writer above mentioned endeavours to prove.

I took two balls of soft clay, one double the weight of the other, and hung them by strings, of equal length, to a nail in the wall. I then drew them in opposite directions from the *line of direction*, the smallest to double the distance of the other, and let them fall towards each other; when they met, all motion ceased; proving that the double velocity of the smaller body, which it is known it acquires, in the present circumstances, exactly counterbalances the double weight of the other body, with half the velocity.

This principle being established, it is easy to demonstrate the following proposition.

If a body is made to slide along a horizontal plane, by a force terminating at a single stroke, the quantity of momentum destroyed by friction, will be equal, in equal times, and not in equal spaces passed over.

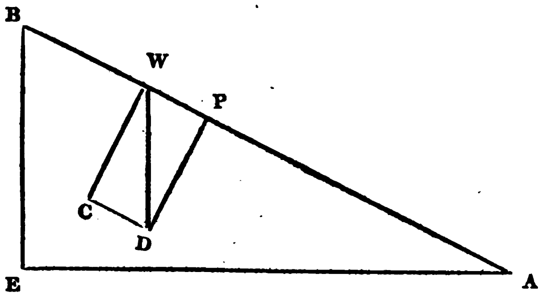
I performed a number of experiments in the presence of the gentleman, whose opinions are here controverted, which I need not now detail, all showing that the spaces passed over by a body on a horizontal plane, when the body comes to rest, are as the squares of the velocity; that is, with a double velocity, a body will move four times as far, and with a triple velocity, nine times as far, &c. before it comes to rest. Now, it is well known, that with such motions, the times which the bodies will move before they come to rest on horizontal planes, are directly as the velocities; that is, equal velocities are destroyed in equal times; therefore, the momenta being as the velocities, the quantity of momentum destroyed in equal times is the same.

J. P. E.

FOR THE FRANKLIN INSTITUTE.

A Reply to the Query, does a body descending on an Inclined Plane with an accelerated motion, press the plane with the same force through every portion of its length?

Proposition.—A heavy body in passing down an inclined plane with an accelerated motion, exerts a uniform pressure on all parts of that plane.



For suppose A, B, an inclined plane, and W, a heavy body resting on any part thereof, and (as lines may be taken as the representa-

tives of forces,) let us assume the straight line, W, D, to be the force of gravity, or weight of the mass W.

Then let us resolve this gravitating force, into two equivalent forces, W, C, perpendicular to, and W, P, in the direction of the plane A, B. It is evident that the part of the weight represented by W, C, will be constantly supported by the plane, and must remain constant, whatever be the velocity, since the force W, P, which alone acts in giving the body motion down the plane, is in the direction of the plane, and cannot change W, C. Q. E. D.

Remarks by the Editor.—In applying the mathematics to the explanation of physical truths, erroneous deductions are frequently made, from the neglect of some of those circumstances in the phenomenon to be elucidated, which influence the result; and such we believe is the case in the foregoing solution.

A body rolling down a plane has its motion accelerated in the same ratio as when falling through free space, and passes, therefore, with increased rapidity, as it approaches the bottom of the plane. Suppose the body, W, to be projected with great rapidity from B to A; let it, for example, be fired from a gun, precisely in the direction of the plane, and just touching it, would it in that case press upon the plane with the same force as when at rest upon it? Now the effect must be the same, from whatever source the motion is derived, provided its velocity be equal. A rapid motion in the descending body resembles a centrifugal force, and operates in the same way in counteracting the effect of gravity. Were the orbit of the earth a solid ring, the earth would revolve upon it without pressing it; but decrease its velocity, or centrifugal force, and it would then press upon the ring: the cases appear analogous.

Bigelow's Elements of Technology.

This work, which has recently made its appearance in one volume, octavo, of 506 pages, from the press of Messrs. Hilliard, Gray, Little, and Wilkins, at Boston, seems eminently deserving of public patronage, as well from the interesting nature of its subject, as from the happy manner in which it is treated. Indeed, the character of its author, and the responsible station in which he was placed, as Rumford Professor, in Harvard University, together with the abundant materials, models, and works on practical science, placed at his command, are a sufficient guarantee for the value of his book. All who have enjoyed the benefits of instruction in that institution for the last ten years, must recollect, with peculiar satisfaction, their attendance on Dr. Bigelow's lectures. They will doubtless recognise as one of the sources of their pleasure, the consciousness, that what they were learning, was not only an accumulation of most valuable facts and principles, but a fund of knowledge, immediately applicable to the wants and the welfare of mankind; and at the same time, demonstrative of the power and resources of the human understanding.

The book before us, contains the substance of those lectures; and to such as know their character, no other recommendation of this volume will be required. It may, however, be proper to state, that the work is not, as some might be led from its title to imagine, a mere *technological vocabulary*, containing the definitions of *words* used in the arts; but that the *things* to which such terms are applied, are the principal objects of Dr. Bigelow's discussion, and that the definition of terms, is incidental only to his main purpose. Though every thing is presented in language, as clear as the English tongue can furnish, yet there is no pedantic display of verbal exactness, so often found in elementary books. The subjects are treated with sufficient minuteness, to aid the student in his elementary inquiries; but not with such particularity of detail, as to fatigue the mind, or to create a supposition that the subject is exhausted, and that more extended treatises must not be afterwards consulted, in order to understand the whole of any one branch of art.

The work is divided into twenty-one chapters, each embracing some great department of the useful arts. The subjects are, the materials used in the arts; their form, condition, and strength; the arts of writing and printing; of designing and painting; of engraving and lithography; of sculpture, modelling and casting; of architecture and building; of heating and ventilation; of illumination; locomotion; elements of machinery; moving forces used in the arts; conveying water; dividing and uniting solid bodies; combining flexible fibres; horology; metallurgy; communicating and modifying colour; vitrification; induration by heat, and the preservation of organic substances.

At the end of each chapter, is a list of such authors and works of value, as treat upon the several subjects. Among these, we confess ourselves gratified at seeing the title of our own journal several times mentioned; because it affords evidence, that our humble labours in this vocation have not been wholly unavailing, towards the promotion of interests so dear to every patriotic mind,—the cultivation and diffusion of useful, practical science.

The plates at the end of the volume are neatly executed. A copious index is added, and must be found extremely serviceable. The mechanical execution of the work does credit to the publishers, and will doubtless contribute to reward their undertaking.

J.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

OCTOBER, 1829.

On the Atmospheric Influence of Woods.

The effects produced on climate, by the preservation or destruction of forests, is an interesting subject of inquiry, which has sometimes engaged the attention not only of philosophers, but of legislators. In France, about forty years ago, some alarm was created, on account of the rapid cutting down of woods, which had then changed owners, or were less carefully protected than they had formerly been. Where wood forms a great part of the fuel of a country, a strong motive will always exist for the planting of trees, and for guarding against their wasteful removal. But another evil than the deficiency of firewood, was then apprehended. It was contended by Cadet de Vaux, and other writers, that the great droughts experienced in some districts, were caused by the absence of the trees, which used to attract the clouds, and thus conduct to the earth those fertilizing showers, which reward the labours of the husbandman with an abundant harvest. Amidst the agitations of the revolution, the complaints of these writers were listened to, and their representations were more than once brought under the consideration of the Convention, and the Council of Five Hundred. We do not precisely recollect what legislative measures were adopted; but we believe, among other things, the sale of the National Forests was stopped. However, it does not appear that what was then done, though it may have saved some of the property in the possession of the state, had any important effect on the whole. Indeed, it will be seen from what follows, that since that period, the woods of France have sus-

tained a considerable diminution, equal in extent to the difference between $\frac{1}{7}$ and $\frac{1}{12}$ of the territory.

In the mean time, the investigation of this interesting subject has not been neglected. The attention of naturalists and men of science in the Netherlands, was, in the course of last year, called to the alterations produced in the physical state of countries, by the destruction of forests, in consequence of a prize for the investigation of this important question, being offered by the Royal Philosophical Society of Brussels. The essay which obtained the prize, was written in French by M. A. Moreau de Jonnes, a staff-officer in the army. It appears that the author does not altogether concur with M. Cadet de Vaux; but we have not seen the original, and the following account has reference to a German translation, by M. Widenmann, Professor of Natural History, at Tubingen. In Germany, where great importance is attached to the subject, the work of M. Moreau de Jonnes has been, upon the whole, very favourably noticed by the reviewers of that country, and we have taken the liberty to make use of some of their observations.

The author begins with a statistical account of certain woods and forests, from which, though he complains of the insufficiency of the documents available for his calculation, at least one conclusion, which appears pretty well founded, may be drawn. According to the data here made use of, the woods in France amounted, in 1750, to more than a fourth of the surface of the whole country; in 1788, to a seventh; and in 1814, to not quite a twelfth of that surface. Thus, within sixty-four years, 5000 square miles of the woods of France must have disappeared. In England, according to the author's estimate, the woods amount to only one twenty-third of the surface.

Chap. I.—*Influence of Woods on the Temperature of Countries.*

Woods lower the temperature. In the author's opinion, they have this effect, because, on account of their dark colour, they reflect back few rays of light and heat to the atmosphere, and because they keep the soil damp, and, therefore, render more heat necessary to promote evaporation. But whether the difference of the mean temperature between Rome and Massachusetts, which, in the same geographical latitude, amounts to 6$\frac{1}{3}$ cents of a degree, is to be attributed almost entirely to the woods, does not appear so easily demonstrable. That woods on mountains have a great influence in intercepting and beating down vapours is very probable; but the author's assertion, that the increased condensation of vapours has for its consequence a greater absorption of heat, is unsupported by proof. It must also be observed, that though woods diminish temperature, and though the author proves this fact by practical observations, yet the experiments as cited by him are so detached, as to leave room for considerable objection. Vienna and Troyes have not a difference of temperature, merely because eastern countries are generally more covered with wood, but also because the site of Vienna is 250 feet higher, and lies nearer high mountains than Troyes. Again, Berlin is colder than Leyden in Holland, not altogether in consequence of Branden-

burg being a woody country, but also because it is exposed to the cold east wind. The translator points out the difference of height, which in the original is unattended to.

The author shows from historical comparisons, that the clearing away of woods makes the temperature of countries warmer. Whether the proofs that he adduces for this purpose are all quite convincing, we cannot positively affirm, though the fact itself is true; for France is no more deprived of its woods than England. If, then, there be, at present, nearly the same degree of heat in London and Paris, while, in the time of Tacitus, Gaul must have been colder, it is not quite clear why this contrary influence should proceed from the same cause. But it is also doubtful whether Tacitus would not, even now, if he had no assistance from the thermometer, call London milder than Paris, because severe winters occur less often in the former than in the latter city. But though the details of these comparisons may occasionally be uncertain, and more particularly those which relate to the question, whether a difference of temperature in former times ought to be attributed solely to the great abundance of woods and forests, yet a collection of the accounts of a greater degree of cold having heretofore existed, is doubtless very important. There can be but few to whom it will not be interesting to learn how much the cold of winter, especially in the south of Europe, has diminished.

Chap. II.—*Influence on the quantity of Rain.*

The author here brings forward some observations to prove that more rain falls on the sea coast than in inland districts, and that, moreover, when chains of mountains run parallel to the sea-shore, the sides next the sea receive more rain than their opposite sides. In reference to woods, however, the author supposes that he may lay it down as a fact confirmed by observation, that woodlands in flat countries do not perceptibly increase the quantity of rain; but that woods on mountains have a perceptible influence in producing that effect. He thereupon founds the conclusion, that if mountains are planted with trees, the quantity of rain in their vicinity will be increased, and that the progressive diminution of rain in the south of Europe is to be ascribed to the destruction of the mountain woods. But the author does not appear to have been sufficiently careful in ascertaining what are the places in which the rain has diminished. It has not diminished in all parts of the south of Europe; for Flaugergues has found that the quantity of rain has considerably increased at Viviers, in the south of France, since 1778. The Milanese Ephemerides indicate the same thing for Milan, and all the assertions of this kind require further demonstration.

Chap. III.—*Of the Influence of Woods on the Humidity of the Atmosphere.*

Here the author describes, among other things, an interesting experiment with the hygrometer, according to which the humidity of the air in the West Indies is found to be expressed by the numbers

3, 4, and 15, according as the observations are made on the coast in the midst of cultivated plantations, on the borders of mountain woods, or in the midst of those woods. There seems, however, to be some obscurity in an observation which the author is induced to make, namely, that the humidity of woods in the torrid zone extends *far* above the extremity of the scale. Now, as the hygrometer is usually graduated up to the point of complete humidity of the atmosphere, it can only be said that the moisture is precipitated in greater abundance than is necessary to bring the hygrometer to the highest degree.

We cannot venture to quote any more of these observations, or to explain the grounds of the doubts to which the conclusions drawn by the author give rise. But notwithstanding these doubts, we confess with pleasure that much information is to be found in the work. At the same time, we must regret that the translator has not given to his version that great superiority over the original which it would have obtained had he subjected several of the author's statements, such as those relative to the comparative humidity of the Mark of Brandenburg and Holland, to critical investigation.

Chap. IV.—*Influence of Woods on Springs and Running Water.*

That countries, especially mountainous countries, which are covered with woods, also abound more in waters than others, is a fact which may be asserted with little fear of contradiction.

Chap. V.—*Of the Influence of Woods on the Wind and on the State of the Atmosphere with respect to Health.*

Though many remarks which occur in this chapter are just, we are much surprised at some of the assertions, and we think we do not err in considering them unfounded. Among these is the assertion, that the impetuosity of the winds, where there are no woods to mitigate its violence, has rendered a great part of Great Britain barren. If the author's estimate, that the waste lands amount to $\frac{22}{73}$ of the whole surface of Great Britain be true, it does not follow that these lands are barren in consequence of a deficiency of trees. The heaths in the north of Germany, which are not all situated in places entirely destitute of woods, show clearly enough that circumstances, which accompany an effect, are not always those which produce it.

The comparison between that part of Tartary inhabited by the Calmucks and Lombardy, appears to be equally unfounded. Whoever, in this instance, though the geographical latitude should be the same, expects to find the climate in both regions alike, and ascribes the dissimilarity of the climate to the want of trees in Tartary, must certainly have allowed many circumstances, which ought to have been taken into account, to pass unnoticed.

Chap. VI.—*Influence of Woods on the Fertility of the Soil.*

We also meet with many remarkable observations and important conclusions in this chapter. But upon the whole, we think that this

essay must be considered as a work which has not been reflected upon with sufficient deliberation. Nevertheless, it contains an abundant collection of curious facts; and though some of these facts are not well applied, and the accuracy of others remains to be proved, the book will, in the mean time, be found an excellent contribution towards the explanation of the subjects of which it treats.

There are, occasionally, some obscurities in the reasoning; but whether these ought to be attributed to the author or the translator, we have not at present the means of determining.

[*Quarterly Journal.*

Account of a new method of Filtering Water, invented by JAMES WHITE, ESQ. Engineer.

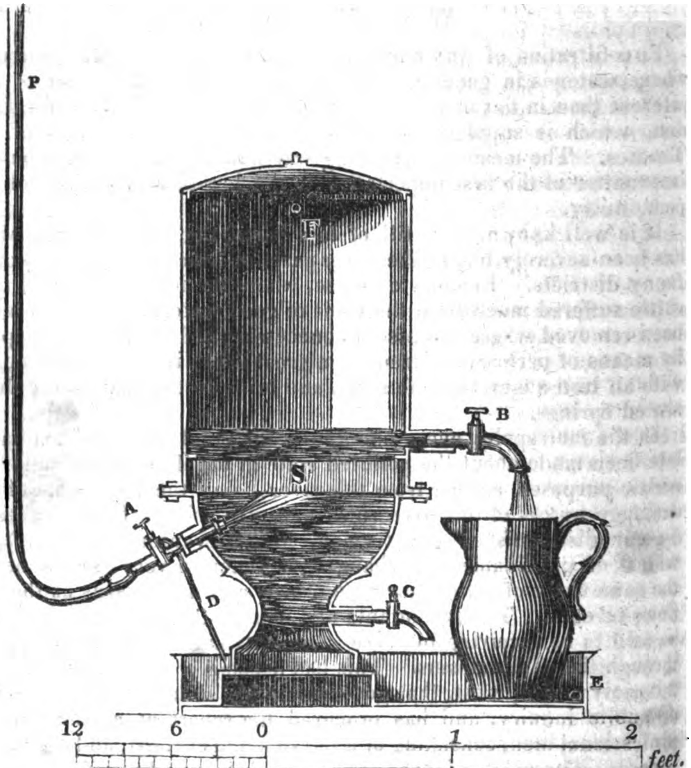
THE filtration of water in a mountainous country like Scotland, where water is in general pure, is comparatively a subject of less interest than in flat and fenny districts, or in great cities like London, which is supplied chiefly from the collected waters of the Thames. The means of purifying water under such circumstances, is a matter of the first importance to the health and comfort of the community.

It is well known, that, till of late years, the want of good water has been severely felt in the lower parts of Lincoln, Kent, and other fenny districts. In some of these, where the inhabitants and their cattle suffered much from the want of good water, the evil has lately been removed where this essential necessary of life has been supplied by means of perforations made to a great depth in the soil, by boring with an iron auger, so as to reach and bring to the surface the deep-seated springs.

In the metropolis, every one knows the great outcry which has of late been made about the polluted state of the Thames water for domestic purposes, arising from this river being the receptacle of the drainage waters of that overgrown city. In point of fact, (as noticed by our distinguished countryman, Mr. Stevenson, engineer,) the waters of the Thames are changed or renewed very slowly, nearly the same body of water moving upwards and downwards as the tide flows or ebbs. The inhabitants of London, therefore, may actually be said to be receiving into the stomach what had formerly passed through the public drains. This has become a subject of so much notoriety and interest, that government has of late made it a matter of public inquiry, and has procured the report of a committee of professional men, consisting of a physician, a chemist, and a civil engineer. The effect of these movements has been to produce numerous plans for supplying the city from a purer source, and also for filtering the water which it already possesses. Among these may be mentioned a plan by Mr. James White, engineer, of Oxford street, London, and another by Messrs. Stirling and Son, of Lambeth, who have invented a machine called the "Rapid Filter," and obtained a patent for it. Having no drawing of Messrs. Stirling's apparatus,

we shall at present confine ourselves to a notice of Mr. White's "Patent Artificial Spring," as given by himself.

"When new inventions, which promise to be of public utility, present themselves to our notice in a simple form, a degree of surprise is excited, that they should hitherto have eluded the research of ingenious men, whose lives have been devoted to mechanical pursuits. It is certain there are but few things of greater importance to the comfort of every family than water, which shall be good in quality, and provided in sufficient quantity for all the purposes of domestic use. That both these effects are produced by this invention, will be best shown by a description of the annexed diagram, and an account of the experiment, as tried at the house of the nobleman who was the first to patronize the design. The figure, as



shown in the diagram, is a section through the centre of the machine, which shows the whole of its interior construction. The cistern containing the water is not introduced, as its height would exceed the limits of the diagram; but let the small pipe, P, be supposed to communicate with it, and be of any length, from 10 to 100 feet: it is, however, necessary to bear in mind, that the quantity filtered will

always be proportioned to the area of the stone multiplied into the height of the column or pipe. The advantage, therefore, of employing a high cistern to supply the machine, requires no other recommendation.

"Three years ago, in the south of Russia, in the government of Poltava, when, on a mission appointed by the late emperor to examine the mechanical and agricultural state of that part of the Russian empire, it fell to my lot to give a design for filtration on a large scale. To effect that object, I introduced the water to be filtered below a bed of sand and gravel: it was intended for the purpose of washing wool, consequently did not require that purity produced by this invention. But at the house of the nobleman I have already alluded to, I attached a half inch leaden pipe to a cistern, which was already fixed thirty-five feet above the ground-floor, where I placed the machine. The other end of the pipe I made water-tight, by fixing it to a nozzle in the apparatus, below a proper filtering stone. Upon turning the cock, A, which shuts off the communication betwixt the machine and the cistern, the water rushed down from the cistern with great force, and very soon displaced all the air contained in the apparatus through the pores of the stone S; after which, the water began to ascend, and to flow in a filtered stream at the cock, B, so as to fill a gallon measure in about two minutes' time. Its appearance in small bubbles, rising through every pore in the stone, from the great pressure of the column of water contained in the small pipe, P, suggested to me the name which I have given it, of an artificial spring; and further experience has fully convinced me, that I have not applied to my invention an unmerited title. From the construction of the apparatus, the sediment and animalculæ will fall to the bottom, and be drawn off at the under cock, C, and run off by the waste pipe, E. In cases where several gallons are wanted at the same time, and it might be inconvenient to wait until it be filtered, shut the cock, B, leave A open, and in a few minutes, with a pressure from a cistern of thirty feet high, eight or ten gallons will be found filtered in the top part of the apparatus, which can be drawn off at B for immediate use, as required. Should it filter more than the top reservoir contains, while A remains open, it will run off waste at F; the cock, A, can be so constructed as to shut of its own accord, but in this case the machine would not be so simple. The cock, A, is of a peculiar construction, and well merits the attention of the reader: at the same time that it shuts off the communication betwixt the machine and the cistern, it opens, when turned one way, through the tube D, a small passage to the atmosphere. By this contrivance, the filtered water in the top part of the machine is allowed to subside the contrary way through the stone, a process which must naturally tend to wash its pores clean; and we know that all filtering substances are subject to get clogged up, from particles of fine sediment lodging in their pores. But what back filtration does not remove in my invention, another beautiful and simple phenomenon completely effects. Open the under cock, C, and then shut it again as fast as possible: this will produce an immense pressure on

the stone, and the water will be forced through with so much rapidity as to clean its pores completely. From what cause, I have not yet been able to ascertain, but it invariably happens, after the process of forcing the air through the stone, that the power of filtration is diminished considerably, and it is several hours before its power is restored. It may be presumed that the air lodges in the pores of the stone, and shows considerable obstinacy in being removed. When back filtration is not required, for it is only necessary for keeping the stone clean, the cock, A, must be shut off, with the notch in the top of it towards the machine, and the filtered water can be retained in the top part of the apparatus for any length of time. Having briefly described the nature of my invention, it remains for me to add, that it is an application of the hydrostatic paradox to the filtration of water, the nature of which admits of its being extended to any magnitude. For example, at the house where my first experiment was tried, the altitude of the cistern was 35 feet, and the area of the stone contained 113 square inches, which sustained an upward pressure from the column of water in the pipe, P, of 1853 pounds, and the product of filtration was at the rate of half a gallon per minute; and since the altitude of the pipe into the area of the stone proportions the quantity, it is a simple question to find what area and altitude together would produce 10, 20, or 100 gallons of filtered water every minute. To produce such effects, a number of stones must be used in the same machine. I believe it yet remains to be proved whether filtered water preserves as well at sea as that which is not filtered. I conceive it will be found to keep equally well, or perhaps better, as filtration removes all animal and vegetable matter which it holds in suspension, the former frequently both in a live and putrid state, a circumstance which cannot reasonably have any tendency to preserve water. Should experience prove that my hypotheses are correct, I would propose, for the benefit of the public in general, and the shipping interest, that a machine on a large scale should be erected at every sea port, where ships are in the practice of taking water, which should be sent at once filtered to sea."

[*Brewster's Journal.*

Account of the Raising of three Stranded Vessels.

Sir,—Several papers have appeared in your Magazine, proposing plans for raising stranded ships. Some of them may, perhaps, be found to possess merit, should any one be inclined to try them; others are somewhat similar to the famous plan of belling the cat, where the only question was who should carry it into effect?

As it may be of use to some of your readers, I will, with your permission, describe to you three plans which I have used with success, in raising stranded vessels.

In 1821, I was employed to float a vessel of 240 tons, which had lost her keel, deadwood, and the lower part of her sternpost. The flat of her footwaling was all gone, and she lay so that there was

three feet water in her at low water. Her two ends and sides were in good condition. In this case I laid a platform in the hold, about one foot above low-water mark; I then calked the platform and foot-waling up to the lower deck clamps, and shored the platform from the beams. The whole of this work occupied about five days. When it was completed, and the water stopped out, the vessel floated, and was then taken to Ipswich, where she was broken up.

Before I adopted this mode of raising her, I tried the plan (about which so much noise has been recently made) of floating her by means of casks attached to her below the surface of the water, but after trying it, without success, for two or three tides, I gave it up. I found, that although I had got as much lifting power by calculation as was required, yet I could not possibly prevent the casks staving each others' heads, or bilging, by the agitation of the sea, when they were in the hold, the pressure of the lower ones bursting those above them, &c.

The next method is one which I used in taking a sloop of about 70 tons register off the beach near Orford. She was lying imbedded in the shingle up to her wales, and, by striking, the stem and stern-posts were loosened, and several planks started. This, however, I did not know at the time, but I observed that the water rose inside and out to the same height. From the appearances inside, I discovered that the two ends were much shaken, although the bottom did not appear to be greatly injured, from the general appearance of the inside plank. As I could not ascertain the precise extent or nature of the injury the vessel had sustained, I used the following method of floating her—for I have generally found that the safe plan has been the most economical in the end. The midship section of a ship approaches to the form of an inverted arch; I saw that the inside plank for a certain extent in the midships was good; this I had calked, and a strong bulkhead, or partition, fitted at each end, which was also made water-tight, and shored in a diagonal direction to the beams and sides of the vessel. The pressure of the water upwards tended to compress the edges of the inside planks closer together; therefore, they did not require to be shored down, for so long as they did not materially decrease in volume, there was no risk of their being forced inwards so as to endanger the safety of the vessel. Just as the bulkheads were completed and ready for shoring, a heavy gale of wind came on, which lasted three days, during which the vessel was driven about a quarter of a mile along the beach, and would, I have no doubt, have gone to pieces, but for the additional strength which the bulkheads gave her to sustain the violence of the seas. The next tide after the gale abated, the damages were repaired, the ship was floated off, and in the course of a few days removed to Ipswich, where she was repaired. It is not often that vessels are stranded so as to allow this plan to be pursued; but where it can be adopted, it is decidedly the most economical, and perfectly safe.

Last year I was engaged in floating a vessel of about 210 tons register, which had been ashore on the Gun fleet sand, where she had struck with so much violence upon a wreck, previously sunk in

the sand, as to carry away all her keel, lower piece of stem, deadwood, and the lower part of the sternpost; several of the after-floors and futtocks were also gone, and the larboard quarter was stove in, to within three streaks of the wales. The after part of the keelson, and the floors attached to it, were raised up at least three feet from their proper position, and in fact, the hull below the lower deck was quite disjointed. She lay in such a situation, that we were able to work from three to four hours, at each low water. I began operations, by placing a tier of beams across about six feet below the lower deck; upon these I laid a platform of deals, which were calked, and made tight; at the forepart of the vessel, a strong bulkhead or partition was erected and calked, and a similar one abaft. I covered the opening in the larboard quarter with deals inside, and calked them. I then had a number of iron bolts made, with a screw at one end, and a broad flap at the other to receive two bolts; these rods were screwed into the keelson and floors at such places as required support, and were bolted at the other end to the beams; after this was all done, I began the shoring. (The topsides of this vessel were but little strained, and the fastenings of the lower deck were uninjured.) I formed, by means of diagonal braces and shores, each pair of beams into a trussed frame. I then placed deals across the platform or spar deck, and fitted perpendicular shores, so that each shore had to sustain the upward pressure of about twelve superficial feet of the spar deck; the bulkheads and quarters were secured in a similar manner, with perpendicular and diagonal shores, which were abutted against firm supports. All the shores were so fitted, that any one of them might be removed, if necessary, to stop a leak. On the fourth day after commencing operations, I had the satisfaction of seeing her afloat, when she was conveyed round to Ipswich, and repaired.

I am aware that there is nothing new in the plans which I have used for floating ships, but as I thought the communication of them to you might, perhaps, be the means of frequently saving a valuable ship from becoming a total wreck, I have ventured to describe them; for it is not the mass of information which we possess, but its applition, which renders it useful.

I am, sir, yours, &c.

GEORGE BAYLEY.

Ipswich, March 31, 1829.

[*London Mechanics Magazine.*

On a method of Rendering Platina Malleable. By WILLIAM HYDE WOLLASTON, M. D. F. R. S. &c.

[From the Philosophical Transactions for 1829. Part I.]

As, from long experience, I probably am better acquainted with the treatment of platina, so as to render it perfectly malleable, than any other member of this society, I will endeavour to describe, as briefly as is consistent with perspicuity, the processes which I put in

practice for this purpose, during a series of years, without seeing any occasion to wish for further improvement.

The usual means of giving chemical purity to this metal, by solution in aqua regia and precipitation with sal ammoniac, are known to every chemist; but I doubt whether sufficient care is usually taken to avoid dissolving the iridium contained in the ore, by due dilution of the solvent. In an account which I gave in the Philosophical Transactions for 1804, of a new metal, rhodium, contained in crude platina, I have mentioned this precaution, but omitted to state to what degree the acids should be diluted. I now, therefore, recommend, that to every measure of the strongest muriatic acid employed, there be added an equal measure of water; and, moreover, that the nitric acid used be what is called "single aqua fortis;" as well for the sake of obtaining a purer result, as of economy in the purchase of nitric acid.

With regard to the proportions in which the acids are to be used, I may say, in round numbers, that muriatic acid, equivalent to 150 marble, together with nitric acid, equivalent to 40 marble, will take 100 of crude platina; but in order to avoid waste of acid, and also to render the solution purer, there should be in the menstruum a redundance of 20 per cent. at least of the ore. The acids should be allowed to digest three or four days, with a heat which ought gradually to be raised. The solution, being then poured off, should be suffered to stand until a quantity of fine pulverulent ore of iridium, suspended in the liquid, has completely subsided; and should then be mixed with 41 parts of sal ammoniac, dissolved in about five times their weight of water. The first precipitate, which will thus be obtained, will weigh about 165 parts, and will yield about 66 parts of pure platina.

As the mother liquor will still contain about 11 parts of platina, these, with some of the other metals yet held in solution, are to be recovered, by precipitation, from the liquor with clean bars of iron, and the precipitate is to be redissolved in a proportionate quantity of aqua regia, similar in its composition to that above directed to be used: but in this case, before adding sal ammoniac, about 1 part by measure of strong muriatic acid should be mixed with 32 parts by measure of the nitro-muriatic solution, to prevent any precipitation of palladium or lead along with the ammonio-muriate of platina.

The yellow precipitate must be well washed, in order to free it from the various impurities which are known to be contained in the complicated ore in question; and must ultimately be well pressed, in order to remove the last remnant of the washings. It is next to be heated, with the utmost caution, in a black-lead pot, with so low a heat as just to expel the whole of the sal ammoniac, and to occasion the particles of platina to cohere as little as possible; for on this depends the ultimate ductility of the product.

The gray product of platina, when turned out of the crucible, if prepared with due caution, will be found lightly coherent, and must then be rubbed between the hands of the operator, in order to procure by the gentlest means, as much as can possibly be so obtained,

of metallic powder, so fine as to pass through a fine lawn sieve. The coarser parts are then to be ground in a wooden bowl with a wooden pestle, but on no account with any harder material, capable of burnishing the particles of platina;* since every degree of burnishing will prevent the particles from cohering in the further stages of the process. Since the whole will require to be well washed in clean water, the operator, in the latter stages of grinding, will find his work much facilitated by the addition of water, in order to remove the finer portions, as soon as they are sufficiently reduced to be suspended in it.

Those who would view this subject scientifically, should here consider, that as platina cannot be fused by the utmost heat of our furnaces, and, consequently, cannot be freed like other metals, from its impurities, during igneous fusion, by fluxes, nor be rendered homogeneous by liquefaction, the mechanical diffusion through water should here be made to answer, as far as may be, the purposes of melting; in allowing earthy matters to come to the surface by their superior lightness, and in making the solvent powers of water effect, as far as possible, the purifying powers of borax and other fluxes in removing soluble oxides.

By repeated washing, shaking, and decanting, the finer parts of the gray powder of platina may be obtained as pure† as other metals are rendered by the various processes of ordinary metallurgy; and if now poured over, and allowed to subside in a clean basin, a uniform mud or pulp will be obtained, ready for the further process of casting.

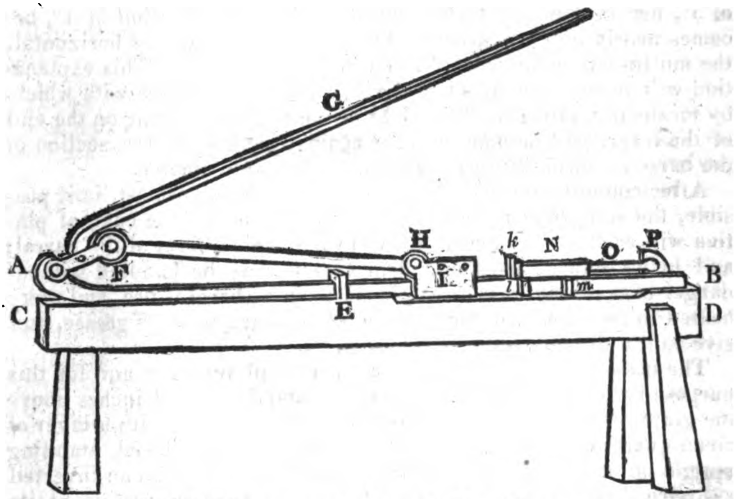
The mould which I have used for casting, is a brass barrel, 6¾ inches long, turned rather taper within, with a view to facilitate the extraction of the ingot to be formed, being 1.12 inches in diameter at top, and 1.23 inches at a quarter of an inch from the bottom, and plugged at its larger extremity with a stopper of steel, that enters the barrel to the depth of a quarter of an inch. The inside of the mould being now well greased with a little lard, and the stopper being fitted tight into the barrel by surrounding it with blotting-paper, (for the paper facilitates the extraction of the stopper, and allows the escape of water during compression,) the barrel is to be set upright in a jug of water, and is itself to be filled with that fluid. It is next to be filled quite full with the mud of platina; which, subsiding to the bottom of the water, is sure to fill the barrel without

* The following experiment will prove the necessity of attending to this precaution:—if a wire of platina be divided with a sharp tool in a slanting direction, and, being then heated to redness, be struck upon an anvil with a hammer, so as to force into contact the two newly divided surfaces, they will become firmly welded together; but if the surfaces have previously been burnished with any hard substance, the welding will be effected, if at all, with very great difficulty.

When the powder of platina has been over-heated in decomposing the ammonio-muriate, or has been burnished in the grinding, I have in vain endeavoured to give it a welding surface, by steeping it in a solution of sal ammoniac in nitric acid.

† Sulphuric acid, digested upon the gray powder of platina, thus purified, extracted less than 1-1000dth part of iron.

cavities, and with uniformity,—a uniformity to be rendered perfect by subsequent pressure. In order, however, to guard effectually against cavities, the barrel may be weighed after filling it, and the actual weight of its contents being thus ascertained, may be compared with that weight of platina and water which it is known by estimate that the barrel ought to contain.* A circular piece of soft paper first, and then of woollen cloth, being laid upon the surface, allow the water to pass, during partial compression, by the force of the hand with a wooden plug. A circular plate of copper is then placed upon the top, and thus sufficient consistency is given to the contents to allow of the barrel being laid horizontally in a forcible press.



The press which I have generally used for this purpose, consists of a flat iron bar, AB, set edgeways, and screwed down by a hook, E, near its middle, where it would otherwise be liable to bend, to a strong wooden bench, CD. The bar is connected by a pivot at its extremity, A, with the lever AFG. An iron rod, FH, which turns at its two extremities upon the pivots F and H, proceeds from the lever at F, and, as the lever descends, propels forward the carriage, I, which slides along the bar. A stopper, or block, being placed in

* From the mean weight of the ingots obtained in previous operations, it is known that the barrel described in the text ought to contain 16 ounces troy of dry platina powder. The weight of the contents of the barrel = 16 ounces $\times \dfrac{\text{sp. grav. of platina} - 1}{\text{sp. grav. of platina}}$ + the weight of a cubic inch of water × capacity of the barrel in cubic inches = 16 ounces $\times \dfrac{20.25}{21.25} +$ ·526 ounces × 7.05 = 18.9575 ounces troy. Should the contents of the barrel weigh materially less than this estimated weight, there must be a want of uniformity in the disposition of the powder within the barrel.

the vacant space, *lk*, the carriage communicates motion to the cradle, *klm*, which is also made to slide along the bar, and carries the barrel, N, which lies upon the cradle, straight against the piston, O, which rests by its end against P, a projection in the further extremity of the bar.

The weight, which in this machine, when the angle of the lever's elevation is small, will keep the power, applied vertically at the extremity of the lever, *in equilibrio* = that power $\times \frac{AG \times FH}{AF[AF + FH]}$ $\times$ cotan. of the angle of the lever's elevation; which expression, in the case of the press actually used, becomes, power $\times$ 5. cotan. of the angle of the lever's elevation. This expression, at an elevation of 5°, becomes nearly 60 $\times$ power, and at an elevation of 1°, becomes nearly 300 $\times$ power; and when the lever becomes horizontal, the multiplier of the power becomes *quasi* infinite. This explanation will be sufficient to show the mechanical advantage with which, by means of this press, the weight of the operator, acting on the end of the lever, will be made to bear against the area of the section of the barrel, a circle little more than an inch in diameter.

After compression, which is to be carried to the utmost limit possible, the stopper at the extremity being taken out, the cake of platina will easily be removed, owing to the conical form of the barrel; and being now so hard and firm that it may be handled without danger of breaking, it is to be placed upon a charcoal fire, and there heated to redness, in order to drive off moisture, burn off grease, and give to it a firmer degree of cohesion.

The cake is next to be heated in a wind furnace; and for this purpose is to be raised upon an earthen stand about 2½ inches above the grate of the furnace, the stand being strown over with a layer of clean quartzose sand, on which the cake is to be placed, standing upright on one of its ends. It is then to be covered with an inverted cylindrical pot, of the most refractory crucible ware, resting at its open end upon the layer of sand; and care is to be taken that the sides of the pot do not touch the cake.

To prevent the blistering of the platina by heat, which is the usual defect of this metal in its manufactured state, it is essential to expose the cake to the most intense heat that a wind furnace can be made to receive, more intense than the platina can well be required to bear under any subsequent treatment; so that all impurities may be totally driven off, which any lower temperature might otherwise render volatile. The furnace is to be fed with Staffordshire coke, and the action of the fire is to be continued for about twenty minutes from the time of lighting it, a breathing heat being maintained during the last four or five minutes.

The cake is now to be removed from the furnace, and being placed upright upon an anvil, is to be struck, while hot, on the top, with a heavy hammer, so as at one heating effectually to close the metal. If in this process of forging, the cylinder should become bent, it should on no account be hammered on the side, by which treatment it would be cracked irremediably; but must be straightened by blows

upon the extremities, dexterously directed, so as to reduce to a straight line the parts which project.

The work of the operator is now so far complete, that the ingot of platina may be reduced, by the processes of heating and forging, like that of any other metal, to any form that may be required. After forging, the ingot is to be cleaned from the ferruginous scales which its surface is apt to contract in the fire, by smearing over its surface with a moistened mixture of equal parts by measure of crystallized borax and common salt of tartar, which, when in fusion, is a ready solvent of such impurities,* and then exposing it, upon a platina tray, under an inverted pot, to the heat of a wind furnace. The ingot, on being taken out of the furnace, is immediately to be plunged into dilute sulphuric acid, which, in the course of a few hours, will entirely dissolve the flux adhering to the surface. The ingot may then be flattened into leaf, drawn into wire, or submitted to any of the processes of which the most ductile metals are capable.

The perfection of the methods above described, for giving to platina complete malleability, will best be estimated by comparing the metal thus obtained, in respect of its specific gravity, with platina which has undergone complete fusion; and by comparing it, in respect of its tenacity, with other metals possessing that quality in the greatest perfection.

The specific gravity of platina, drawn into fine wire, from a button which had been completely fused by the late Dr. E. D. Clarke with an oxy-hydrogen blow-pipe, I found to be 21.16. The aggregate specific gravity of the cake of metallic mud, when first introduced into the barrel, exclusively of moisture, is about 4.3; when taken from the press, is about 10. That of the cake fully contracted, on being taken out of the wind furnace before forging, is from 17 to 17.7. The mean specific gravity of the platina, after forging, is about 21.25, although that of some rods, after being drawn, is 21.4: but that of fine platina wire, determined by comparing the weight of a given length of it with the weight of an equal length of gold wire drawn through the same hole, I find to be 21.5, which is the maximum specific gravity that we can well expect to be given to platina.

The mean tenacity, determined by the weights required to break them, of two fine platina wires, the one of $\frac{1}{3000}$, the other of $\frac{1}{3850}$ of an inch in diameter, reduced to the standard of a wire $\frac{1}{10}$th of an inch in diameter, I found to be 409 pounds; and the mean tenacity of 11 wires, beginning with $\frac{1}{4500}$ and ending with $\frac{1}{25.000}$ of an inch,

* The chemist will find this flux very serviceable for removing from his crucible, or other vessels of platina, those ferruginous scales with which, after long use, and particularly after being strongly heated in a coal or coke fire, they become incrusted. In the analysis of earthy minerals, I have been in the habit of using a similar flux, composed of 2 parts by weight of crystallized carbonate of soda, and 1 of crystallized borax, well ground together. It has the advantage of not acting, like caustic alkali, upon the platina crucible, and is a powerful solvent of jargon and many other minerals, which yield with difficulty to other fluxes. If the mineral to be operated on requires oxidation, in order to decompose it, a little nitre or nitrate of soda may be added.

reduced to the former standard, I found to be 589 pounds; the maximum of these 11 cases being 645 pounds, and the minimum 480 pounds. The coarsest and the finest wire which I tried, present exceptions, since a wire of $\frac{1}{1500}$ of an inch gave 290 pounds, and a wire of $\frac{1}{30.000}$ of an inch, 190 pounds. If we take 590 pounds, as determined by the 11 consecutive trials, to be the measure of the tenacity of the platina prepared by the processes above described, and consider that the tenacity of gold wire, reduced to the same standard, is about 500, and that of iron wire, 600, we shall have full reason to be satisfied with the processes detailed in the present paper, by which platina has been rendered malleable.

To this paper I beg to subjoin an account of some processes relating to two of the metals which are found in the ore of platina.

To obtain malleable palladium, the residuum obtained from burning the prussiate of that metal is to be combined with sulphur, and each cake of the sulphuret, after being fused, is to be finally purified by cupellation, in an open crucible, with borax and a little nitre. The sulphuret is then to be roasted, at a low red heat, on a flat brick, and pressed, when reduced to a pasty consistence, into a square, or oblong, and perfectly flat cake. It is again to be roasted very patiently, at a low red heat, until it becomes spongy on the surface. During this process, sulphur flies off in the state of sulphurous acid, especially at those moments when the heat is allowed occasionally to subside. The ingot is then to be cooled; and when quite cold, is to be tapped with a light hammer, in order to condense and beat down the spongy excrescences on its surface. The alternate roastings and tappings (or gentle hammerings) require the utmost patience and perseverance, before the cake can be brought to bear hard blows: but it may, by these means, at length be made so flat and square, as to bear being passed through the flatting mill, and so laminated to any required degree of thinness.

Thus prepared, it is always brittle, while hot; possibly, from its still containing a small remnant of sulphur. I have also fused some palladium *per se*, without using sulphur; but I have always found it, when treated in this way, so hard and difficult to manage, that I greatly prefer the former process.

To obtain the oxide of osmium in a pure, solid, and crystallized state, I grind together, and introduce, when ground, into a cold crucible, 3 parts by weight of the pulverulent ore of iridium, and 1 part of nitre. The crucible is to be heated to a good red in an open fire, until the ingredients are reduced to a pasty state; when osmic fumes will be found to arise from it. The soluble parts of the mixture are then to be dissolved in the smallest quantity of water necessary for the purpose, and the liquor, thus obtained, is to be mixed, in a retort, with so much sulphuric acid, diluted with its weight of water, as is equivalent to the potash contained in the nitre employed; but no inconvenience will result from using an excess of sulphuric acid. By distilling rapidly into a clean receiver, for so long a time

as the osmic fumes continue to come over, the oxide will be collected in the form of a white crust on the sides of the receiver; and there melting, it will run down in drops beneath the watery solution, forming a fluid flattened globule at the bottom. When the receiver has become quite cold, the oxide will become solid and crystallize. One such operation has yielded 30 grains of the crystallized oxide, besides a strong aqueous solution of it.

Observations on the manner of Manufacturing Indigo in the Southern Provinces of India; with some Remarks on its Chemical Changes and Combinations. By Charles H. Weston, Esq.

Dr. Bancroft introduces his observations on indigo by the following strong expressions: "The subject of this article is the most interesting, important, and instructive, which can occupy the attention of a dyer or a chemist; the admirable and singular properties of indigo being only surpassed by those of the colouring matter of the murex and the buccinum a little, while it is of much higher practical utility than the latter."* Perhaps there are few men better qualified to form an estimate on this point than Dr. Bancroft, who had removed from the art of dying generally so much that obscured it, and had thrown so much light on the changes and chemical characters of indigo in particular.

Not only, however, has it claims, from its peculiar chemical characters, upon the attention of the scientific man, but the important part it now holds in our exports from India, must also interest the man of business in its favour. The indigo of the East Indies, which at one time ranked so low in its comparative value, has, by a better mode of manufacture, been progressively improving, and, consequently, as gradually making its way into European markets, till, at length, the exports of the West, of Spanish America, and the West Indies, have been to a great extent transferred to the East.† This is a conquest indeed, but it is a conquest which English *intelligence*, as well as enterprise, has accomplished. To those, therefore, in whose minds the bare mention of the word "theory" is but too apt to call into action every latent prejudice, and to secure to it the most determined opposition, this very striking instance before us, among many others which are daily occurring, of the great advantages resulting from the combined assistance of theory and practice, should lead such, at least, to question the propriety of their hatred to all theoretical knowledge. The tendency of scientific information, as it lays open causes and effects, is, to point out what parts of the process are superfluous, and what may be improved; and, "in proportion as science advances, all the principles become less compli-

* *Vide* "Experimental Researches concerning the Philosophy of Permanent Colours." By Dr. Bancroft.

† It is, I believe, computed that British India supplies three-fourths of all the indigo brought into European markets.

cated, and, consequently, more useful; and it is then that their *application* is most advantageously made to the arts."* In the following remarks, I shall endeavour to bear in mind the comparative value of both theory and practice.

There will be no occasion for me to make any remarks upon the botanical characteristics of the indigofera tinctoria, as they are already so well known.† Upon the *mode*, however, of manufacturing, or rather of separating, the valuable dye from the indigo leaves, something, it appears to me, need be said; inasmuch, as in works written professedly upon this subject, I have only met with one method of conducting this process, namely, the green or fermenting process; by which is intended the *fermentation* of the plant fresh cut and green in vats properly prepared for the purpose. There is another method the very reverse of this, the production of indigo from the *dried* leaves of the plant *without* fermentation; and this is the method which is to be the subject of the following remarks.

I shall slightly touch upon the cultivation and growth of the plant, making a few observations on its peculiar structure, and its wonderful adaptation, both to the climate and the soil in which it is destined to exist.

Immediately after the great periodical fall of rain, which takes place during the monsoon months of the latter part of October, November, and the beginning of December, the ground is ploughed up and properly prepared for the reception of the seed. The time of sowing will, of course, depend on local situation—the elevated parts sowed before the monsoon has quite passed by, while, from fear of inundation, the low tracts remain untouched till a later period.

The plant requires a light soil, little, but timely rain, and much sunshine. Rain should fall immediately after the plant shows itself above the ground, for by it the plant is not only invigorated, but cleansed from those innumerable insects, which otherwise would have fed upon, and destroyed the leaves.

From this time, comparatively little rain is required, if it fall opportunely, that is, at the different stages of the growth of the plant. After the first cutting of the branches, it sickens, and at that period rain is particularly necessary for its proper restoration. The same remarks will, of course, apply to the like periods between the other cuttings.

This plant, unlike the Bengal plant, is only made use of for *one* year, during which the branches are cut off from the stem three or four times, after which the ground is ploughed up for another sowing. But each successive growth of the branches produces an increased deterioration of the qualities of the leaves; so that one part of the leaves of the first cutting would yield as much indigo as two parts of the third crop.

The produce of the leaves is very precarious, for excessive rain is

* *Vide* "Elements of Agricultural Chemistry." By sir H. Davy.

† See the botanical characters of the indigofera genus in Rees's Cyclopedia, and their classification by Dr. Bancroft.

almost as destructive of the *properties* of the plant, as continued drought is of the plant itself. The rapidity of the growth of plants during much rain, in the temperature of the tropics, is extraordinary, and a proportionate deficiency in all that characterizes the vegetable world necessarily follows. This we find to be the case with all forced vegetables; and the mildness of the radish of hastened growth, when contrasted with the highly pungent and almost acrid flavour of the slowly and gradually advanced one, may be adduced as explanatory of this observation. Besides this general remark, however, there are other considerations in some measure peculiar to this plant. Indigo contains an extraordinary quantity of carbon, to obtain more or less of which carbonic acid gas must be decomposed; the plant retaining the carbon, and transpiring pure oxygen gas.* But as this important change can only be effected when the plant is under the direct and immediate influence of light, rainy weather, by intercepting the sun's rays, prevents the accomplishment of this very important part of vegetable economy. Hence it is, as is practically well known to manufacturers, that the indigo plant, however fine and luxuriant, as is the natural result of much rain, is very deficient in *produce*, and a similar loss is experienced even if the plant, without the fall of too much rain, has grown up under *cloudy* weather. Sunshine, much and continued sunshine, is essentially necessary for the proper exercise of those secretory organs by which this peculiar drug is formed and perfected.

This plant is destined, therefore, to exist under a burning sun and much deficiency of rain; how then is it to obtain its necessary supply of water? Nature, who invariably so well adapts the means to the end, has, in this instance, displayed her usual wisdom. The root, instead of being short, and branching off in different directions, and reaching to various depths, is one continuation of the stalk, which, decreasing gradually to a point, after the manner of the common garden radish, descends perpendicularly into the ground, to the depth of about three feet. While, therefore, the plant is necessarily exposed to the continued heat of a broiling sun, it is deriving benefit from the moisture of that part of the soil, which always remains uninfluenced by any external heat. I before stated that the nature of the soil should be light and sandy; and the non-conducting powers of the sand, in reference to caloric, afford a sufficient reason for the complete protection of the root. I have often found that, while the surface at mid-day was too hot to allow the hand to remain in contact with it, the temperature of the sand, at even a short distance beneath the surface, was gratefully cool.†

* There are, indeed, some plants which must derive the *whole* of their carbon from the atmosphere. Sir H. Davy remarks, "many plants that grow upon rocks or soils containing no carbonic matter, can only be supposed to acquire their charcoal from the carbonic acid gas in the atmosphere." In the sandy soil of India there certainly cannot be enough of vegetable matter to supply a proper proportion of carbon.

† A good instance of the non-conducting power of sand is given in the following extract:—"The red hot balls employed by the garrison of Gibraltar to destroy the Spanish floating batteries, were carried from the furnaces to the bastions in *wooden* barrows, with only a layer of sand interposed, and this was

There remains another reason why the plant can endure drought so continued. As dew is the condensation of the aqueous vapours exhaled by the sun during the day, the quantity of dew, *cæteris paribus*, will always be in the direct ratio of such heat; and hence it is, that, in clear, still nights, after such unclouded weather, the fall of dew within the tropics is immense. Now, this water, so precipitated during the absence of the sun, completely envelops the entire plant, and is copiously taken up by those absorbing vessels, which form a part of the wonderful physical structure of the leaves of plants. Thus is it constantly restored to the full exercise of all its powers, ready to receive the renewed action of the sun's rays, so necessary for effectuating the decomposing process before mentioned.*

But plants, like animals, transpire, as well as absorb, moisture, and equally vary in their power of doing so. Less quantity of water is, therefore, necessary for the growth of one genus of plants, whose transpiration is limited, than for the wants of those of another genus, whose transpiration is more extensive.† Now, although the extent of transpiration may be dependant upon, and be in proportion to, the absorption of water, and *vice versa;* and, therefore, as the absorption is extensive, the transpiration must be so likewise;‡ yet may there not be some *balance* in favour of the absorbing powers over the transpiratory powers of the plant?§ These appear to be some of the methods which nature adopts to meet those apparent difficulties, the continuance of an unclouded sky, and the constant and necessary supply of water.

It may be further remarked, that in the growth and formation of this plant, beside the water essential to the solution, or carrying in suspension different vegetable, alkaline, or earthy substances, to the plant—much water is not wanted: because, as hydrogen in the ultimate products of indigo,‖ forms rather an unimportant part, the decomposition of water must be proportionably limited.

found sufficient to prevent the balls, though in a high state of incandescence, from setting fire to the wood."—*Tilloch's Philosophical Magazine.*

* "In very intense heats, when the soil is dry, the life of the plants seems to be preserved by the absorbent power of their leaves; and it is a beautiful circumstance in the economy of nature, that the aqueous vapours are most abundant in the atmosphere, when they are most needed for the purposes of life."—*Davy's Agricul. Chemistry.*

† *Vide* Ure's Chemical Dictionary, article "Vegetable Kingdom," and Brande's Manual of Chemistry, vol. i.

‡ See this stated in Dr. Thomson's extensive observations upon "Vegetables," in his system of Chemistry.

§ We learn from Mr. Bonnet's "Researches concerning the Use of Leaves," the great extent to which vegetation can be carried by the water absorbed *solely* by the leaves, although *transpiration* was, at the same time, going forward. (*Vide* Thomson.)

‖ These, according to Dr. Ure, are—

Carbon	71.37
Oxygen	14.25
Hydrogen	4.38
Azote	10.
	100.

We now return to the cultivation of the plant, and view it as gradually advancing to maturity. As it approaches this period, the colour of the leaves changes from a light to a dark green—yet this change is not gradual, but is quickly acquired a short time before the branches are fit to be cut. Much judgment on this point is required, for the evils arising from premature cutting are great, and much of the good effects of antecedently seasonable weather would be neutralized by such a mistake. The consequences are, a deficiency of produce, and an unequal absorption of oxygen in the beating vat. When the plant is fully matured, the branches are severed from the parent stem early in the morning, and spread out in the sun till the afternoon. By this time they are so desiccated, that the leaves are easily separated from the branches, by simply beating them with a stick. The leaves, so separated, are housed in warehouses, closely packed, and well trodden down by natives.

The importance of *properly drying* the leaves, will be easily understood, when we learn that the leaves are not immediately used, but are kept so packed for one month. Moisture very soon produces fermentation, involving either a partial or total destruction of the colouring matter. Deficiency of produce, is, of course, the natural result of such change, and where no such bad effects have been felt, the use of *ill-dried*, or green leaves, produces an effect in the beating vat, similar to that which is consequential on premature cutting.

The leaves, however, when properly dried, do not remain for one month without suffering a very *material change*, and accomplishing a very important object. We find, at the expiration of this period, that the colour of the leaves has passed into a *light lead colour*; by additional keeping, the lead colour gradually darkens until it becomes black. Experience has found that the leaves will not give out any colouring matter to cold water, until the first change has commenced to take place,—that the maximum quantity of indigo is to be obtained when the lead colour is effected, and that, from this period, a loss in the quantity of indigo always accompanies, and is in proportion to the extent of such further changes. But, perhaps, the *necessity* of keeping the leaves, and the *nature* of the important change so accomplished during that period, will be better proved and elucidated by a perusal of some memoranda of a few experiments I made in India.

No. 1. " Digested some *green* indigo leaves from the plant, fit for immediate cutting, in *cold* water, for twenty-five minutes;—the slightest *yellowish* extract, only, was produced.

2. " *Green* mango, and other leaves, digested in cold water for two hours, gave no extract.

3. " *Green* mango, and other leaves, *boiled* for an hour and a quarter, gave a clear reddish brandy colour to the water, and the leaves of a creeping plant similarly steeped, produced a yellow tinged with green, not clear, but leaving a sediment.

4. " Boiled the *green* indigo leaves taken from a plant fit for *immediate* cutting, for two hours and ten minutes. The liquor was

decidedly a *greenish* yellow. This left on the filter the *smallest* quantity of indigo, and the solution, after twenty-four hours, became darker, and a little more indigo was precipitated. Both precipitates, however, most inconsiderable.

5. "Green solution of indigo in cold water, prepared from the *dried* leaves taken from the heap which had been one month in the warehouse, was kept in rapid ebullition for one hour, and water was added to supply the loss by evaporation;—the *whole* of the indigo was precipitated, and the supernatant liquor was of a clear dark morone colour.*

6. "Indigo leaves, taken from the ripe plant (part of which was used in experiment No. 1,) after *ten days' keeping*, gave to the *cold* water, in which they were digested for twenty-five minutes, a fine *grass green colour.*

7. "Mango, and other leaves, well *dried* and *kept* spread out on paper for ten days, gave to *cold* water a deep brandy colour.

8. "*Boiled* for a short time, some *green* leaves taken from the ripe indigo plant, and obtained, by filtration, a brandy colour solution with a greenish tinge: half part of which (No. 1,) was exposed to the air, and the other half (No. 2,) was poured back over the leaves equally exposed to the air: No. 1 remained unchanged, and, when boiled, became only a darker brown, and gave no precipitation of indigo: No. 2 subsequently *fermented*, and *afterwards* became a good green.

9. "Green leaves, digested in *cold* water for one-quarter of an hour, filtered, and kept exposed to the action of the atmosphere for fourteen hours, remained *unchanged.*

Cold water, allowed to *remain on the leaves* for fourteen hours, became green."

Now, the legitimate inferences to be deduced from these experiments, I conceive to be these:—

1. That as the green leaves of plants give no colour, and the leaves of the indigo plant no blue colouring matter to water by simple infusion, (Exp. 1 and 2,) and the same leaves, after desiccation, and exposure to the atmosphere for many days, will, under the same circumstances, give out what is essentially the colouring matter of the leaves (Exp. 5, 6, and 7,) the warehousing the indigo leaves for procuring indigo by the dry process is *necessary.*

2. That the blue principle does *not* exist in the leaves *ready formed*, or in a state of separation, (Exp. 8 and 9,) but requires some new arrangement of its component parts to effect such separation;—and,

3. That the *absorption of oxygen* is necessary either to produce such new arrangements, or to complete some incipient arrangement of its constituent parts (Exp. 4, 5; No. 2 of 8 and 9,) and, so to separate the blue extract, as to make it soluble in water, and, therefore, the *change* effected by one month's keeping, seems occasioned by an *absorption of oxygen.* [*Quarterly Journal.*

[TO BE CONTINUED.]

* The effects of boiling upon this supernatant liquor will be mentioned hereafter.

On the Construction of Fire-proof Buildings. *By* Ignatius Bonomi, Architect.

One great, and perhaps the principal cause of the destructiveness of fires in large buildings, is the want of arched surfaces of incombustible materials. This has been disastrously exemplified in the destruction of the choir of York Minster, where the roofs of the aisles, which are solidly arched with stone, suffered no injury; while the choir-roof, although much more raised above the action of the fire, has been entirely destroyed by it: and there is little doubt but that the whole roof of the church would have suffered the same fate, if its continuity had not been interrupted by the walls of the tower.

The use of arched surfaces of solid materials cannot be too strongly recommended. In no part of our church architecture is the skill of the contrivers so conspicuous, as in the art employed in the construction of the vaulting, in order to procure strength and reduce the lateral pressure, which they effected by a frame-work of stone, of sufficient depth, converging towards the points of support, and by filling in the intervals with thinner material. They thus imitated the structure of the vegetable leaf, in which the fibres centre upon the stem, as the ribs or frame-work of the arch on its support; at which point, also, the buttress meets the ribs, to counteract the lateral thrust.

In many instances, to render the construction lighter, surfaces of *brick* are used between the stone ribs; and, where extreme lightness is required, *hollow pots* (cylindrical within) of well burnt clay, would prove an excellent substitute for bricks. The use of these was not unknown to the Romans, who also employed *pumice;* this porous material possessing the additional advantage, when combined with good cement, of rendering the arched surface one united petrification, opposing (in consequence of its firm union) little lateral pressure, comparatively, against the sustaining walls.

A very frequent occasion of fire is the frequent necessity for the repair of *lead gutters*, which requires the use of braziers on the roof. This necessity would, in a great degree, be obviated by the adoption of gutters of *cast-iron*, or of *solid lead* cast in troughs, and having spouts at proper intervals to carry off the water. The action of the sun upon gutters, which, by expanding the metal, is the principal cause of their failure, might also be much diminished by a thin covering of stone or slate, sufficiently perforated for the percolation of water. This contrivance would also have the advantage of preventing the lodgment of snow, which is apt to freeze in the gutters and occasion the water to overflow, to the damage of the building, and particularly of the timbering of the roof.

Another cause of fire, is, the use of roofs of timber, especially when connected with the roofs of other buildings. In such cases the substitution of *iron* for wood would afford security; and if, in the use of iron, care is taken to make the rise or pitch of the roof sufficient to prevent indirect strains, and to *tie in* the feet of the

main supports or triangles, there can be no danger of failure, provided the strength of the iron is proportioned to the weight it has to carry. If, however, the building has an arched under roof of solid materials, and care is taken to prevent the necessity of continual repairs to the lead-work, the danger of fire, even from a roof of timber, is very considerably obviated. In adverting to the use of a substitute for wooden roofs, it may be proper to specify that in some instances the slated surface might be carried upon *cross walls*, supported by the arches and divisional works of the building.

In a paper written for the express purpose of recommending precautions against fire in the construction of public buildings, it will hardly be deemed foreign to the purpose to state the impropriety of collecting into one room great numbers of books, or works of art. Even if security is obtained against fire from without, there is always danger to be apprehended from the use of lights within; and one spark igniting might occasion the destruction of the whole contents. The present collocation of the libraries of the advocates and writers to the signet in Edinburgh, presents a striking instance of this kind of risk.

The means which may be recommended for securing such valuable collections from destruction by fire, are, in the first place, to use *incombustible materials* in the construction of the buildings containing them; and, secondly, to subdivide these collections into suites of separate rooms, which may be connected by wide and high *doors of metal*, rendered ornamental by plates of bas-relief, made to open upon pivots, and poised with mechanical skill, so as to be easily moved. By these precautions, should a fire unfortunately destroy the contents of any one room, it might be prevented from extending to the adjoining apartments.

It is not here intended to enter further into the details of construction, or to refer to the use of arches upon cast-iron beams and sheets of metal, &c.: but it is desirable to explain, that an excellent surface for interior finishing may be obtained, by using (instead of lath and plaster,) a lining of brick *detached from* the exterior walls. This not only affords a security against fire, but has the additional advantage of interposing a medium of air between the inner and outer walls, which, by its slow conducting power, will prevent the interior of the building from partaking of the variations of the outer atmosphere, and, consequently, in cold weather, will avoid the precipitation of moisture on the inner walls. To conclude, the examples afforded us in the ancient buildings of our own country, and those of Rome, present to the architect's contemplation a source of study on the subject of solid vaulting, in which, however dissimilar the forms, he will discover the application of the same mathematical principles of construction, combining strength, lightness, and economy of material.

Durham, March, 1829.

[*Ib.*

ENGLISH PATENTS.

To John Robertson, *Rope Manufacturer, for improvements in the manufacture of Rope or Hempen Cordage.* Dated 4th Sept. 1828.

The improvements, for which this patent has been granted, consist principally in impregnating the spun-yarns with tannin previously to their being twisted into cordage; and the manner in which this is effected, is, by steeping them in an infusion of oak-bark, sumach, catechu, or valonia, until its action on them is completed.

Three pounds of oak bark to a gallon of water is the proportion that the patentee prefers for the infusion, or such a quantity of the other substances mentioned, as will be equivalent thereto, according to the tannin contained in them.

For Russian or Italian hemp, twenty-one days submersion in the infusion will be, in general, sufficient; and fourteen days for New Zealand hemp, for that from Manilla, or for other articles of a similar quality.

The oak bark (or any of the other substances mentioned) is to be left to infuse in water in pits, baques, or other proper receptacles, for three or four days, before the yarn is put in; which latter is then to be coiled down into it, so as to occupy as much of the receptacle as is possible, consistently with being perfectly immersed.

When the action of the infusion on the yarn is finished, it is to be taken up, well drained, and then thoroughly dried; after which it is to be twisted into the different sorts of ropes or cordage required, by the means usually employed.

The patentee asserts, that the impregnation of the rope yarn in this manner, will so much increase its durability as to make any addition of tar to it totally unnecessary.

Obs.—The importance of an invention, that will produce any material saving in the consumption of hemp, may be estimated from the consideration of the large sum annually paid to Russia alone for that article, which we are informed is no less than two millions on an average. Hence, if Mr. Robertson can prove, that tanning the rope yarn increases the durability of cordage in any considerable proportion, he will greatly serve his country, as well as himself; as the dependence on Russia for such a large quantity of a material so essential to our navy, must cramp the political councils of our government in a quarter, where, at the present crisis of foreign affairs, restraint of any kind is most injurious.

To compare the tanned cordage with that which has been tarred, goes, however, but a small way towards establishing this desirable point; since it has long been the opinion of very good judges of the subject, that tar increases little or nothing the durability of cordage, and by no means adds to its strength; the acid contained in tar tending, in their opinion, to its premature decay, and the stiffness caused by this material rendering it more liable to break, wherever it be considerably bent. We have, it is true, often seen tanned sails

used in vessels, particularly in small craft, but we know of no documents to prove the expediency of the practice; and believe it has in general been adopted from an inference drawn from the effect of tanning on hides, that has no firm foundation; since hemp contains no substance analagous to the gelatin of the hides, that is rendered insoluble by the tannin; on which chemical action the whole efficacy of the process depends.

As a farther argument of the inefficacy of tar for the preservation of cordage, we may state that experiments are now in progress in the Government Rope Yard at Woolwich, on the advantages of substituting a solution of caoutchouc for this substance; which of course would not be necessary if tar were not acknowledged to be inadequate for the purpose. These experiments we have reason to think have hitherto been attended with success; and we have little doubt of the decided superiority of the proposed substitute, the only drawback to the use of which appears to be in its expense; but we have hopes, that even in this respect no insuperable obstacle will exist to its adoption, since, in the first place, we are informed, that a very small proportion of the solution is sufficient for the purpose; secondly, caoutchouc, we believe, might be obtained in any requisite quantity from our Indian settlements, and from South America; and the plants that produce it might also, doubtlessly, be cultivated advantageously in many of the British colonial establishments; thirdly, coal-tar oil, that is asserted to be a good solvent for it, is inexhaustibly abundant; and fourthly, though we are not acquainted with the solvent employed by the gentleman, who has proposed its use to government, so as to judge of its expense, yet we are aware of a preparation of it, or rather of a pliant varnish in which it was a principal ingredient, that was found to be very efficacious; in this one pound of it gave the qualities required to no less than seventy pounds of linseed oil (now a very cheap article;) the method of preparing which varnish may be found in our 24th vol. second series, p. 157, in the specification of Mr. Clark's patent for making beds and other articles, of flexible cases filled with air; an invention now likely to obtain great public notice, from some new applications of it of great utility, that have been lately discovered.

We take this opportunity to state, that we understand great efforts are about to be made for the cultivation of the New Zealand hemp plant, the Phormium tenax, in Ireland, (where it thrives remarkably well,) and in other parts of the United Kingdom, with a view to free us from all dependence for hemp on foreign nations. The Phormium tenax so much resembles our common flags, or iris, in its leaves, that there can be little doubt, that like them it would grow well in any moist soil. Its fibres are so much stronger than those of common hemp, that it has been proved, by accurate experiments lately made in the Royal Rope Yard, at Woolwich, that cordage made of it of three-quarters of the substance of that of common hemp, will be equally strong; which alone will occasion a saving of 25 per cent. in its consumption, exclusive of the important political advantages to be derived from it before noticed. [*Repertory Pat. Inven.*

To John Benjamin Macneil, *Engineer, for improvements in preparing and applying materials for the making, constructing, and rendering more durable, Roads and other Ways; which materials so prepared, are applicable to other purposes.* Dated May 6, 1828.

The chief materials alluded to in this title, consist of clean sharp sand, and Roman cement, in the proportion of one-eighth of each, added to six-eighths of chippings of granite, or of other hard stone, broken flints, or clean gravel, mixed up with a proper quantity of water, equal to about a quarter of the whole: this mixture as soon as made is either to be put into moulds of the shape nearly of rectangular paving stones, and when firmly set in that form, to be used in the manner of such stones, in covering the road way, previously well levelled transversely; or without using moulds, is to be at once spread over the road way, so prepared, to a proper thickness, and then being scored across in small angular channels, at proper intervals (which may be equal to six or eight inches) to let the rain water drain off into the sewers at each side, is to be covered with a coat of a proper thickness of broken granite, or other hard stone, or of gravel. The other materials mentioned are flat hard stones, such as are used in pavements, or hard bricks, which are to be applied in covering the road way, in the same manner as the blocks of the composition above mentioned.

Though Roman cement is preferred in making these blocks, yet other cement formed of lime, or other fit substance, may be used. To facilitate the preparation and mixture of the foregoing composition, a square platform or level floor, may be used, made of flat stones, bricks, or boards, having edges raised up at three of its sides, on which floor the materials are to be worked up to a proper consistency.

According to the proportion of the moulds for shaping the composition into blocks, represented in the drawings, their length is to be about two and a half measures of their breadth, and their depth is to be about a quarter more than their breadth, which quarter will nearly allow for the bevelling of the angles of their upper surfaces, with which they are to be constructed, to form channels when they are laid together, through which the surface water may pass into the drains, under the upper coat of broken stone or other materials. Twenty or thirty of those moulds are exhibited in the drawing, formed in one long case, or coffer, supported on four wheels, to facilitate the conveyance of the blocks to the place, where they are to be laid out to dry, and become hard. Several moveable vertical partitions running down in grooves across the coffer, divide it into the desired number of portions for the formation of the blocks, which, when raised, easily permit the latter to be removed; and the bottom of each mould, having its angles filled up by ledges of a triangular transverse section, will shape the part of the block next it, into a proper form for its upper surface. Moulds of many other forms may

be likewise used for the same purpose, but those mentioned are preferred by the patentee,

The great object of the preceding method of constructing roads, is to prevent the wet, in the first place, from penetrating into the soft clay, or earth, beneath the road, and converting it into mud, as usually happens in common roads and ways during wet weather; and next, to hinder such soft matter, if produced in this or any other way, from rising up between the interstices of the upper coat of hard materials in the concussions they will receive from heavy carriages passing over them; and also at the same time, to make impossible the penetration of these upper materials, into any soft substances, that may happen to lie under the road from any cause whatsoever.

Besides the formation of roads, the composition mentioned may be used in the construction of sea-walls, or the embankment of canals or rivers; the sides and bottoms of docks, locks, and bridges, and in other aquatic works of various descriptions, either by previously forming it into rectangular blocks, of proper sizes, in the manner before stated, and then using them with fit cement, as building materials; or the embankments or other walls, may be made by placing coffer dams, or cases, or their front only, (according to circumstances) of the most convenient size, where the walls are required, and then pouring into them, or behind them, the materials before particularized, after being worked up with water into the state best suited for the purpose.

Obs.—There can be little doubt, that the above described method of making artificial blocks, to form a sub-stratum for roads of broken stones, would be very serviceable in districts where small stones or gravel can alone be procured naturally, or without enormous expense in carriage; and though the first cost of roads, so formed, will occasion an objection to them, and perhaps the only one that can be made, yet it requires but little information to be aware, that many places exist, (where the sub-soil of the country is either clay or some other yielding substance) in which, what would be saved by such roads in preventing the frequent repairs, necessary in the present mode of constructing them, would make them in process of time, the cheapest that could be used.

We understand, that a trial of the artificial blocks of the patentee is being made in the road adjoining to the Highgate Archway, as a sub-stratum to the other materials of the road; but we think the choice of this place for the experiment, by no means judicious, as the sub-soil there is not deficient in ordinary firmness, and is besides extremely well drained, by its considerable elevation; whereas, in order to prove the advantage of the plan, the situation for the experiment should be one, where the sub-soil was soft, and at least not above the level of the adjacent country; such as might be easily found at the Surrey side of the river, and in many other places not farther from town than that chosen.

We regret to say, that the great thoroughfares of London, (where some of the plans of the patentee might be most beneficial for the

durability of the ways,) are so intersected by the pipes of the numerous water and gas companies, and would be necessarily so frequently broken up for the repairs and alterations which they must require, that but little advantage could arise from covering the ways in any manner better than that used at present, in paving them with blocks of granite. The enclosing these pipes in subterraneous passages, or *sub-ways*, proposed by Mr. Williams, promises at least a means for the removal of this objection; but the great number of these pipes in many streets, forms an obstacle to this plan, that is superable only by such a powerful interference of government (for the removal of all pipes over the very few absolutely necessary for the supply of water and gas,) as we much fear will never be exerted. [*Ib.*

To George Johnson Young, *Iron Founder, for a Machine, whereby an additional and improved purchase or power will be given in working Ships' Windlasses and Capstans.* Dated 21st June, 1828.

In the improved windlass, described in the specification of this patent, an axle is placed above, and parallel to the body of the windlass, of sufficient strength for the purpose to which it is applied, and supported at each end by the windlass-bits: on this axle are fixed four or more small flat vertical cylinders, at equal intervals asunder, having several square holes in their edges for the insertion of the butts of handspikes, by which the whole is turned round: there is also fixed on one end, or both the ends of this axle, a pinion, or small toothed wheel, with strong teeth; and immediately beneath these pinions, large toothed wheels are fastened to the body of the windlass, on which they are made to operate by chain-bands, the alternate links of which fall in between the teeth of the pinions and of the wheels, and cause them to turn simultaneously. In this first method the windlass body is kept from recoiling, by palls supported by a pall-bit in the usual manner; but in a variation of the windlass afterwards mentioned, an additional security against this accident is given by a sort of pall, hinged to every second intermediate link in the chain-band, (and which are somewhat curved inwards, that they may lie close to the chain-band in those parts of the revolution, where they are not required to act,) that fall in between the serrated teeth of the segment of a wheel, or ring, toothed internally; which is fastened vertically to the deck, directly under the large toothed wheel on the windlass-body, and sufficiently near to it, to receive the palls mentioned, as they come round. Another variation in this windlass consists in making the axle, that carries the pinions, in two parts, (but in the same line,) meeting in the middle in the pall-bit, but in other respects constructed as that before described.

The chain, of which the chain-bands are formed, is of a particular kind, and seems essential to the second sort of windlass, but not to

the first; it is composed of hollow cylindrical links, equal in their heights and diameters, connected by other links, like square frames, when viewed in front, but which consist each of two flat pieces joined by round bolts, that pass through the cylindrical links: every second one of these latter connecting links, has the flat pieces belonging to it made of a triangular shape, with one angle of each piece projecting from the chain; and between those projecting angles the curved palls alluded to are fastened by bolts, that pass through one of the ends of each pall, and through both the projecting angles.

This same sort of chain is used also with the improved capstan, only varying, in having neither curved palls nor triangular plates in the connecting links. The spindle turns round within the body of this capstan independently; and has a separate head, (for receiving the butts of capstan bars) attached to it above that of the capstan: the bottom of the capstan is hollow, and has a metallic ring fastened at its lower edge, formed with internal teeth all round, having semi-cylindrical interstices: on the lower part of the detached spindle a small wheel is fixed, having teeth round it, with interstices similar to those of the ring; and coming almost in contact with it, another wheel of the same form and size, and in the same position, is placed on an axle that is secured to the deck, and round those two small wheels a chain-band, of the sort of chain last described, is passed, the cylindrical links of which serve the double purpose of making the two small wheels revolve together, and of acting on the teeth of the toothed ring at the bottom of the capstan; as these cylindrical teeth project sufficiently beyond the latter small wheel, to fall into the semi-cylindrical cavities between the teeth of the ring.

By this arrangement, when the spindle is made to revolve, by capstan-bars applied to its head, the body of the capstan will turn with a power so much greater, as its diameter exceeds that of either of the small wheels; but when so great a power is not required, the capstan body may be made to turn with more velocity by applying the bars to its own head; in which case the spindle will revolve in the same direction with a slower motion within it, that will occasion a friction, which, however, is too slight to be of any consequence.

In like manner the windlass may be worked more quickly, by applying the handspikes to its body, instead of to the disks on the axle; and also in some other cases, where great power is not wanted, the axle may be made to revolve by handles, or winches, placed on its ends, which project beyond the windlass-bits sufficiently for this purpose; and on one or both of those projecting ends, small cylinders may be also fixed, which will be useful for hauling the running-rigging of the vessel, as well as for other purposes; and will thus supersede the necessity of having on the deck the second small windlass, worked by winches only, that is usually placed close to the mainmast in merchant ships.

Obs.—Chain-bands were first applied, to connect revolving tooth-wheels, by the celebrated M. Vaucauson, many years ago; but he only used them where the power employed was so small that bent

wire was sufficient for their links; we may, therefore, consider their application to turn heavy machinery for overcoming great resistances as a novelty not yet sanctioned by experience. The patentee states in his specification, that the teeth of wheels, with which chain-bands are used, are much less liable to break "in heavy lurches of vessels" at sea, than those of wheels that act immediately on each other; this we believe, because the strain is by the chain divided over several teeth of the wheels at the same time; but unless he can prove that chain-bands themselves are less liable to break than the teeth of wheels acting in the usual manner, no advantage from their use evidently can exist to compensate for their additional expense. We can, moreover, see no benefit in the teeth for wheels, that he has recommended, as we think the chains would be more liable to slip over the semi-cylindrical interstices between them, and of course have a less firm gripe on the wheels than if the teeth were made in the usual manner.

We have also to observe, that the manner of giving increased power to the capstan described by the patentee, is similar in its principles to that for which Captain Kent obtained a patent previous to 1827, the chief difference between them being in the use of chain-bands by the present patentee, in place of the interlocking toothed wheels employed by Captain Kent. [*Ib.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN JULY, 1829.

With Remarks and Exemplifications, by the Editor.

1. For an improved machine for *Mortising, Boring, and Sawing;* Reuben Medley, Bloomfield, Nelson county, Kentucky, July 7.

The inventor of this machine has not pointed out any particular part which he claims; we are, therefore, left to the conclusion, that the whole is new. The sawing part, is, we apprehend, intended principally for cutting tenons; at all events, it is designed for articles of a moderate length only. A saw frame is moved vertically by a crank, and the article to be cut is fastened upon a carriage forced forward by a feed hand; the piece to be mortised is to be secured, and made to advance in the same way, a second crank working the frame up and down, in which the chisel is fixed. The augers, or bits for boring, are to be fixed in the end of a vertical cylindrical shaft, working both above and below, through holes in guide pieces; a screw is cut upon the shaft, and in one of the guide pieces, or collars, and, in consequence, when the shaft is turned, the auger is raised, or lowered, by the action of the screw. By means of two fixed, and two moveable, whorls, and of two bands, one of which is crossed, the shaft may be made to turn in either direction, so as to force forward, or to withdraw the auger. The whole machinery is to

be moved by drums, whorls, and bands, acted upon by hand, or other power.

The only point of novelty which we perceive in this instrument, is, in the mode of forcing the auger forward, and withdrawing it; we are very apprehensive, however, that if this part be really new, it will not be found to be very useful. Bits, or augers, rarely admit of being forced forward by screws, and where they do, they must be screws of a very fine thread, but little calculated for the rapid whirling motion intended to be given by the kind of machinery which we have described.

The absence of any claim, leaves the patent upon, what appears to us, a very insecure basis.

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2. For a new and useful *Mode of Purifying Water* by means of a machine denominated the "Patent Filterer;" George Busby White, New York, July 7.

The specification of this patent has the merit of brevity, it being in the following words.

"This improvement consists of a cistern constructed of any suitable material, and of any size or shape required; it is lined with water-proof cement, or any other proper substance. The cistern is filled with small stones, having a partition, or division, across it, permitting the water to pass under it from one end of the cistern to the other. The water is introduced at the top of one end, and passing through the bed of small stones, and under the partition, then rises up to its level in the second department, until it overflows into the reservoir." GEORGE BUSBY WHITE.

There is no drawing accompanying the specification, and, consequently, one of the absolute requirements of the patent law has been disregarded. The law says, "and shall accompany the whole with drawings and written references, wherever the nature of the case admits of drawings." That the nature of the case would *admit* of a drawing in the present instance, any one may perceive; and the *model* which the patentee has himself sent on, testifies to the fact.

Some of our readers who are acquainted with the progress of inventions, may tell us that there is no novelty in the plan of Mr. White; that it has been proposed to filter the water for the supply of whole cities, by a similar, but more perfectly arranged mode of operating; and may remind us, that patents have been already obtained for filtering apparatus, in which sand, gravel, and other substances have been employed to purify the water, which has been made to percolate these materials, *per latus*, *per ascensum*, and *per decensum*. All this is true, but, of course, Mr. White was uninformed upon the subject. It is one which has been much agitated of late in England, in consequence of the disgusting and increasing filth of the water of the Thames, from which the city of London derives a large portion of its supply for domestic use, and we have, in the present number, inserted an account of a very simple and ingenious plan which has been carried into actual operation in England,

by a namesake of the present patentee; it will also be seen that the same gentleman has employed a bed of sand and gravel for filtering in the large way. Were we to publish all that we possess in the foreign journals, and other works, relative to this process, we should fill a volume with the matter, and render it manifest that something more recondite than the plan before us must be brought forward before a claim to novelty can be sustained.

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3. For an *Improvement in the Hoe;* Gideon Freeborn, New York, July 7.

The following thirty words comprise the whole of the specification.

"The improvement consists solely in the use of malleable cast-iron, as a material for the formation of the eye, to be fastened with rivets, or to be welded on."

We admire brevity, but it should be coupled with clearness, and this certainly is not the case with the foregoing description. What is the "malleable cast-iron" intended? Is it cast-iron rendered malleable by annealing? Will iron of this description weld? We apprehend that the annealed cast-iron is the kind meant, but are not aware that this can be welded.

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4. For a *Horizontal Rack and Pinion Cotton Press;* Zenos Bronson, Jesper county, Georgia, July 7.

Horizontal presses for packing cotton, are well known in the south. The improvement proposed by the present patentee, is, the forcing the follower of the press onward, by means of a rack and pinion. In the drawing, there are two large cog wheels, and three pinions, used, by which any desired power may be obtained.

The claim is to "the application of the rack and pinion, in the way described, for the purpose of packing cotton into boxes, or bales."

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5. For an improved mode of making and applying *Splints to Fractured Limbs;* David S. C. H. Smith, Physician, Sutton, Worcester county, Massachusetts, July 7.

These splints are to be made of hatter's felt, which is to be saturated with shel-lac varnish. Moulds formed of plaster of Paris, or of carved wood, may be employed to give the varnished felt the proper shape. The felt is to be cut of such a size as to form a splint which will embrace rather more than one-half of the limb. When the varnish is dry, these splints are sufficiently stiff to retain the form given to them. To adapt them to a fractured limb, they are to be held over the steam of boiling water, which will render them sufficiently pliable to admit of their being moulded by the hand, and of acquiring their final form from the limb itself. Counter splints are placed on the opposite side of the limb; these counter splints have buckles attached to them, which receive straps from the splints, to secure them in their places.

The patentee says, that "among the prominent advantages to be

derived from the use of my felt splints, as above described, are, that the splints, when properly applied to the fractured limb, prevent its shortening, and all motion between the divided ends of the bones. And as the splints can be exactly fitted to limbs of every kind and description, a bandage may be firmly applied without causing pain, excoriations, swelling, or other bad consequences arising from the unequal pressure of the splints."

"In fractures of the lower extremities, as of the leg below the knee, as, for instance, when both bones are broken, the patient can rise from his bed without the assistance of any one, and move about upon crutches during the whole process of cure, not being under the necessity of being confined to the bed after the first shock of the injury has passed, and the consequent inflammation subsided, which usually takes place in five or six days; and in common cases, no confinement is required."

"What I claim, is, the *felt*, and the application of it to fractured limbs."

This claim is rather awkwardly expressed, as we apprehend that the Doctor does not mean to claim the *felt*, but his mode of forming it into a splint.

The moulding of splints to the limb is not new, and of this the patentee appears to be aware. Fractured limbs have been enclosed, in whole, or in part, in plaster of Paris, and other devices have been adopted for attaining the same end; but, perhaps, the present may be a real improvement upon all previous modes; we hope it may prove to be so, but in this case we shall regret that the Doctor had not followed the example of the numerous individuals among the members of a liberal profession, who have improved the art of surgery, and devoted their improvements freely, to the aid of their brethren, and the relief of suffering humanity. Not that we think it improper, or incorrect, in a surgeon, to secure to himself, in certain cases, a fair remuneration for his discoveries. Trusses, or other instruments applicable to the cure of chronic diseases, appear to us fair subjects for patents; but the physician and the surgeon would be unpleasantly situated, were he compelled to purchase a right to the use, or forego the employment, of every discovery and improvement made within the last fourteen years.

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6. For a method of *Cleaning or Hulling Rice*, coffee, clover seed, and other grains or berries requiring to be hulled; Zenos Bronson, Jesper county, Georgia, July 7.

A number of hollow cylinders are made to revolve horizontally upon gudgeons, and parallel to each other. They may be made of wood or metal; and each of them is to be furnished with a door near to one end, to admit the grain, or other article to be hulled. Iron balls, rounded pebbles, or other hard substances, are put into these cylinders, the friction of which against the grain, is to produce the intended effect.

The cylinders are to be placed in a frame near the ceiling of a

room; there are to be holes in the floor above, and supply spouts, corresponding with the openings in the cylinders. The frame is hinged so that the ends of the cylinders having the doors in them, may all be lowered, to deliver the grain, &c., the balls, or stones, being prevented from falling out by means of a grating.

A band is passed alternately above and below the cylinders, to cause them to revolve.

"What I claim as new, is, the mode of cleaning or hulling by means of revolving cylinders, in which the operation is performed by hard substances placed within them, as above described."

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7. For an improvement in *Working Pumps*, called the "Geared Pump;" Manuel Francis, Boston, Mass., July 7.

The patentee begins by telling us, "my invention consists in the application of a windlass, and a train of multiplying wheels and pinions, so constructed as to work a pump by the power of a weight applied to the windlass, or barrel."

Need we tell any thing more about the invention? certainly not to one who has passed the *pons assinorum* in mechanics.

There are three wheels, working in three pinions, each increasing the motion about threefold. The last pinion carries the pitman, or shackle-bar, which is to work the pump. A ratchet wheel and click is attached to the barrel upon which the rope sustaining the weight is to be wound. "A balance wheel proportioned to the moving power, is attached to the arbor of the crank."

The hope to obtain an increase of the effective power of a machine, whilst the motive power remains unchanged, results from a total ignorance of what is meant by the quantity of motion, and this ignorance is the parent of most of the absurd propositions which are made in mechanics. In the example before us, besides this error, there would be a loss of about one-third of the power applied from the friction of wheels and gudgeons, and the rigidity of cords.

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8. For a *Double Acting Pump*, with one cylinder and piston; Russel Wileman, East Hartford, Hartford county, Connecticut, July 9.

Double acting pumps with single pistons are by no means new; they were not so when used at the old water works in Philadelphia, nearly thirty years ago; they are now employed in an improved form at the new works, and have been variously modified, according to the purpose for which they were required, or the fancy of the maker.

To those who understand the construction of Boulton and Watt's double acting engine, it is only necessary to say, that the pump for which Mr. Wileman has taken a patent, resembles it very closely. Imagine the induction, to be the supply pipe, and the eduction, the delivering, or discharging pipe, and you have the whole apparatus.

In the plate which forms the bottom of the cylinder, there are cavities to connect it with the supply and discharge pipes; these are claimed by the patentee, and are, in fact, the only things abso-

lutely claimed, the remainder being *conditional*, and in the subjoined words, "the other parts described in this specification I claim only so far as they shall be found original with myself."

The patentee thus leaves it to others to discover what is new in the construction of his machine, a task which, we apprehend, the law will not impose upon them, and, if it did, it is one which we fear they might find it difficult to perform.

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9. For a machine for *Dressing Hemp and Flax;* Horace L. Barnum, and Matthew Stevenson, M. D. The former of Washington city, D. C., the latter of Cambridge, Washington county, New York, July 8.

This, like most of the breaking machines for hemp and flax, is to operate by fluted rollers, mashing into each other. A large iron cog wheel is made to revolve by any suitable means. The teeth of this wheel drive pinions upon the ends of rollers which are placed around it, so as to embrace about three-fourths of its circumference. In the drawing which accompanies the specification, twelve rollers are represented, one side being left free to supply and deliver the hemp.

The rollers above described stand at a small distance from each other, and are surrounded with another set of fluted rollers. The gudgeons of these exterior rollers are placed so as to stand exactly opposite to the spaces between the interior rollers, so that the flutes of one exterior may mash into those of two interior rollers. This, where there are twelve of the latter, will, of course, require eleven of the former.

There is a feeding apron to supply the hemp to be broken, which is placed opposite to the upper pair of rollers, and a receiving cloth, upon which it is delivered from the lower pair. In passing between the two rows of rollers, the hemp or flax receives an undulating motion, being acted upon twice by each of the rollers, in consequence of each mashing into two others. This, it is said, gives a decided advantage to the machine.

The gudgeons of the exterior rollers work in slots, so that they may be borne up against the interior, by means of springs, weights, or pulleys, or by a weighted lever, the latter being preferred, as it is readily graduated to any desired pressure.

The patentees claim, "the application of the moving power, applied to fluted, or other rollers, for the purpose exemplified, or for any other purpose to which it may be applicable."

"The disposition of the fluted, or other rollers, without limiting their dimensions, or without confining themselves to any number of rollers, or any particular mode of gearing them."

"The *mode* of applying the lever, or pulley, to give the pressure."

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10. For a machine for *Separating Gold Dust, Grains and Particles from the Ore,* and other minerals lighter than gold; Richard Lee, Rutherford county, North Carolina, July 8.

The new and inviting business which now claims the attention of a large number of the citizens of North Carolina, the search after gold, is likely to give birth to many contrivances for conducting the washing and other operations of the mines. The business, as it is new, is of necessity conducted in a rude manner, and in some situations where considerable quantities of gold are found, we are convinced that not more than 50 per cent. of that contained in the ground is separated; we speak from actual knowledge, and credible information.

Although in a business so long pursued in other countries, the ingenuity and skill of those concerned have produced many admirable devices for attaining the end proposed, it is difficult to become acquainted with them, as they are, in general, very imperfectly described in books, and the best works upon the subject are in foreign languages, particularly in the German, as it is principally in Germany and in South America, that this business has claimed attention.

The principle of operation in the machinery now patented, has not in it any thing of novelty, and we think it inferior in its details to some which have been described. The ore to be washed is to be placed in a long trough, a little inclined. The lower end of the trough stands over a hopper, or funnel, in which there is a skreen, or sieve, to detain the coarser pieces of stone, or ore. The matter which washes over passes down into a trunk, or trough, the end of which inclines upwards, that the water, and lighter particles of earth may flow out, and leave the heavier portion behind. The larger particles of gold may afterwards be picked out, and the finer separated by amalgamation.

The claim is to "the trunk, or body of the machine, with its spout and funnel."

Were we to undertake to conduct operations in the gold district, we should industriously seek information respecting plans long followed and approved; an inquiry more likely to produce useful results than any thing which will, probably, be discovered, whilst what has been previously effected remains unknown.

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11. For a *Machine for Dressing Hair*, called a Hatchelling Machine; William Chubb, New York, July 9.

A cylinder about 3 feet in diameter, and 18 inches in length, with its axis standing horizontally, is made to revolve upon a suitable frame. Strips of iron formed into teeth, stand along the cylinder at regular distances from each other. In front of the cylinder there is a feeding cloth upon rollers, like that of a carding machine. Just above the feeding cloth, and upon the same plane with it, there is a sliding frame, with a contrivance for confining the hair to be dressed, or hatchelled. This frame is carried forward by a rack and pinion, moved by cross levers, or arms. The cylinder and feeding cloth are to be put in motion by any suitable power; the frame confining the hair is to be moved by hand.

The claim is to the general principle and construction of the machine, and to its application for dressing hair, hemp, &c. &c.

What is the kind of hair to be dressed, or hatchelled, we are not told, or for what purpose it is so prepared, nor are we possessed of the information requisite to form any certain judgment upon the subject; we cannot, therefore, offer any opinion upon the merits of the machine.

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12. For an improvement in the method of *Heating Rooms and Houses*, by means of a furnace called the "Cylindric Air Heater;" Charles Fowler, Hartford, Connecticut, July 10.

This Cylindric Air Heater consists of three concentric cylinders placed vertically, one within the other, with spaces between them for the passage of air. The inner cylinder is the stove to contain the fuel, the second or middle cylinder is to be made of tin plates, and the outer of sheet iron. A large tube passes from the outer to the inner cylinder, through which the fire is to be fed. This opening is at about the middle of the cylinder, and is closed by a door. A pipe to convey off the smoke, runs directly up from the stove, through openings in the tops of the two outer cylinders. Air is freely admitted below, which is to pass up, become heated, and be conveyed by pipes wherever it is wanted. These air pipes pass from the spaces between each of the cylinders, and form a connexion with each other.

For a stove so constructed, the patentee claims a decided superiority over all that have preceded it. He states that it is cheaper, requires less fuel, can be easily removed; "and also in this, that the interior [middle] cylinder being constructed of bright tin, is by no means a good conducter of heat, so that comparatively very little heat is absorbed by, or escapes from, it, and, consequently, the air between it and the stove becomes more readily heated, and, therefore, a greater quantity of it must pass off through the flues; and also in this, that it has two cylinders, the exterior of which being of sheet iron, retains all, or nearly all, the heat that escapes from the interior," &c.

Now it unfortunately happens that all this is very bad philosophy, which, however, would be of little importance in the present instance, if it had not led to a gross error in practice. It is assumed that tin is a bad conductor, and that the black sheet iron will retain nearly all the heat; whilst the fact is, the tin is considerably the best conductor of the two, whilst the sheet iron will part with its heat by radiation, at least six times as rapidly as the tin. The latter, to have answered the design of the inventor, should have formed the outer cylinder, whilst the inner might have been made either of sheet iron, or of tin.

We cannot here discuss the subject of the two modes by which heat is distributed, namely, conducting power and radiation; a knowledge of them, however, is very important in its practical applications, and ought to be acquired by those who undertake to econo-

mize heat. The subject is by no means intricate, and is explained in every elementary book upon chemistry.

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13. For *Casting of Iron Ploughs in one Entire Piece;* John Boynton, South Coventry, July 10.

"This plough differs from all others, in that it consists wholly of iron, and is cast in one entire piece, excepting the share and handles, and these may be cast together with the body of the plough if required; but the handles to be of wood, and the share to be separate, so as to be taken off for sharpening, or altering, is thought best.

"The beam is cast something wider and thinner than common wooden beams, and to strengthen it, there is at top and bottom, on both sides, a rib, or moulding, and in the centre of the off side, one projecting considerably further than the others. In the end of the beam are three holes, in which to hook the chain, and by shifting from one to another, the plough is regulated to go more or less deep. To support the mould board, is a brace, or bar, uniting at one end with the mould board, and at the other with the near or land side of the plough. The handles are fastened on by screws and nuts, and are connected together by a brace, or ring, in the usual way.

"The shape of the beam; the number of holes in it; the shape of the mould board, and the size of the plough, may be varied if required; the intention of the inventor being principally to secure the right of casting the whole, or body of the plough, in one entire piece."

The foregoing is the whole of the specification; the object of the patentee, therefore, is merely to secure to himself the right to cast the bodies of ploughs in one entire piece. We have taken occasion in several instances to express our doubts of the validity of such a claim, and we are also unable to perceive the utility of the proposed *improvement,* as we apprehend that the extra difficulty in moulding will be fully equal to the cost of a few short bolts and nuts.

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14. For a *Current and Tide Wheel,* for driving mills for grinding, and other purposes; Asa Madison, Detroit, Wayne county, Michigan Territory, July 10.

This we believe to be a new plan for a tide, or current wheel; at all events, it differs from all those with which we have been hitherto acquainted. There are numerous plans for hinging or hanging the floats or buckets, so that upon one side of the wheel they shall expose their edges, and on the other their flat surfaces to the action of the water. In the plan before us, the buckets are to slide in grooves, so that they may all be actually upon one side of the wheel.

The wheel has no axle, or shaft, passing through it, but has round ends upon which gudgeons are fixed; the ends being connected together by iron rods passing from one to the other, between the floats, and near the rims. On the inside of each end of the wheel, pieces are fixed which form grooves in which the floats are to slide from one side of the wheel to the other. A stationary semicylindrical

curb, or case, is to surround that half of the wheel which is not to be acted upon, in order to throw the current on the opposite side.

The means by which the floats are to be made to pass from side to side, are not specified, as it is said that this may be effected in various ways; it is observed, however, that "the floats on an inclined wheel may be changed by making them buoyant." To cause them to slide with ease in the grooves, or upon the ledges by which they are kept in their places, it is proposed to furnish them with friction wheels.

The claim is to the construction of a wheel in which the buckets shall change from side to side, without regard to the number of buckets, the inclination of the wheel, or other circumstances.

Such a wheel is pretty enough in theory, and if the floats could be made to pass from side to side with the same facility with which their action can be described, they would be excellent in practice. We are extremely apprehensive that the fond hopes of the patentee will never be realized, as we believe that this shifting motion cannot, in any way, be advantageously effected; we also think that weeds, boughs, and other articles carried along by the current, would materially interfere with the regularity of the sliding action, did not any stronger objections present themselves.

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15. For a Parallel moving *Perpendicular Tooth Extractor;* Elijah Bryan, New York, July 13.

The construction of this instrument may be conceived by supposing it to be formed by uniting one pair of the forceps used for extracting teeth, and which always make a part of the sets of instruments for that purpose, to a part of another pair, in the following manner. Grip the jaws of one pair between those of another pair, their handles standing at right angles to each other; then suppose the handles of the first pair to be cut off just above the rivet, and the jaws of the second pair to be united to the outside of the others, by means of a joint which will operate both as a hinge and swivel; by opening or closing the handles of the forceps, the claws which are to embrace the tooth will also open and close. A part of the shank of the forceps, or of a projecting piece attached to it, is to rest upon a tooth, or teeth adjoining that to be drawn, so as to form a fulcrum upon which to bear the instrument in extracting a tooth. This bearing or fulcrum is to be covered with India rubber, leather, or some other elastic substance.

The claim is to the making of the claw, to move on pivots or swivels in the act of extracting a tooth, and its application to that purpose, however the same may be modified.

Numerous perpendicular extractors have been made and patented, and there are but few dentists who have not essayed, and rejected them, in consequence of the many objections to them in practice. It is not often that the adjoining teeth will bear the pressure necessary to extract one which is firmly seated; many teeth may be more readily drawn in a curved, than in a vertical direction, and a skilful

operator, with a firm hand, and a strong wrist, will, in four cases out of five, be perfectly satisfied with the common instrument, or with the forceps. If a man is deficient in mechanical skill, in strength of hand, or in a knowledge of the structure of the teeth, he will, of course, make bad work in what is at the best a very rough operation; but with these prerequisites, the existing difficulties are but few. It is freely admitted that the ordinary instrument is defective, and that an improvement upon it is much to be desired, but the arrangement now proposed does not appear to us to be more likely to produce the desired end, than several previous attempts.

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16. For a machine for *Washing and Churning;* Joel B. Pratt, Milo, Yates County, New York, July 14.

A box, or trough, with a semi-circular bottom, formed of slats, or ribs, running in the direction of its circumference, and a shaft made to turn, or vibrate, by a crank, with teeth, or pins, projecting from said shaft, and mashing in between the slats, constitute the main part of this machine. In this trough the clothes or the cream are to be *raked*, until the one is cleaned, and the other transmuted into butter. The patentee says, "what I claim is the rake, with its motion, as before specified."

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17. For a *Strap Cutting and Punching Machine;* Charles Angel, Philadelphia County, Pennsylvania, July 15.

We are unable to give a satisfactory description of this machine, as it does not appear that there is any drawing of it in the patent office, although it is absolutely necessary to its validity that one should accompany, and make part of the specification. The description is evidently written with much care, and, to himself, the explanations given by the writer, were undoubtedly very clear; but in all instances it requires a peculiar aptitude, and, in many cases, it is impracticable, perfectly to describe a machine, in words, without drawings; and hence the wisdom of that provision of the law which makes the demand for them, absolute.

The cutting machine appears to consist of a piece of wood sliding in grooves, with a cutting knife extending downwards, and sloping back at such an angle as to render the cutting easy; several thicknesses of leather are to be cut at once, there being proper means provided to regulate the width of the straps.

The punching machine consists of a block, sliding up and down between two guide pieces, there being several hollow punches projecting from the lower side of the block, and fixed at proper distances from each other. The block with the punches, is to be forced down by a lever, and afterwards the straps drawn forward, and another row of holes punched.

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18. For an improvement in the art of *Fulling and Felting*

Cloth; John D. Lounsbury, John Arnold, John A. M'Lean, and George G. Bishop, Norwalk, Fairfield County, Connecticut, July 15.

The patentees use their machinery either for fulling, or felting, but consider it as peculiarly applicable to cloth made without spinning or weaving, with the wool delivered from the carding machine.

A large drum, or cylinder, the periphery of which is formed of slats, is to receive the cloth. This cylinder turns upon gudgeons, the lower side of it dipping into a trough lined with lead, and containing an acidulated liquid, within which the cylinder is to be made to vibrate backwards and forwards. A furnace, or heater, is attached to the trough, to give to the liquor the degree of heat which may be desired. This constitutes the first operation.

A second machine, consisting of several pair of wooden rollers, standing over a trough, is next used. The rollers must be of sufficient length to allow cloth of the width to be felted, to pass between them, which it is to do repeatedly. They may be plain or fluted, and are to be pressed together by weights and levers, "this operation hardens the texture, evens the fibres, and smooths the surface of the web."

The first machine is not claimed as a new invention, it having been used on a smaller scale for washing; but its application in its enlarged form, for the fulling of cloth, is claimed. The attaching a heater to the trough, and the alternate motion given to the cylinder, are also claimed.

The principle of the rollers in the second machine is not claimed, they having been used for other purposes; but the present application, and the connecting a trough with them, are considered as new, and claimed accordingly.

It is an error to suppose that machines similar to the one first described, have not been made of a very large size. Dash wheels for washing or rinsing cloths, &c. are well known in bleach grounds, and other establishments where cloth requires this operation; they are similar in form to that now spoken of, and of very large dimensions.

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19. For a machine for *Forming the Web for Cloth* of wool, hair, or other suitable substance, without spinning or weaving; John Arnold, Norwalk, Connecticut, July 15.

Two carding machines are to be placed at right angles to each other, in such a way, that whilst the batt from one is received upon an endless cloth, that from the other may be made to cross it at right angles, the latter being cut off by machines for that purpose, at the edges of the former. Instead of cutting, it is proposed, sometimes, to leave a part of the doffing cylinder without cards, so that the batt shall be delivered in proper lengths for crossing. The parts of the machine generally, although differing in their arrangement, are similar in their operation to those for the same purpose which we have recently described.

20. For an improvement in the construction and *Application of Wheels to Carriages* of pleasure, or of burden; George Bridgman, New Haven, Connecticut, July 16th.

The object proposed by Mr. Bridgman, is, to construct wheels which shall have the effect of "rendering the moving of any heavy body much easier than in the common method, and being capable of surmounting any obstacle which may intervene to prevent the movement, or progress of a carriage, with less physical, or mechanical power, than in any other method heretofore known or used."

In the method proposed, eight wheels are to be used where four formerly answered the purpose. Four of the wheels are to be large in diameter, and the other four so small as to be capable of being placed between the hub and rim of one of the large wheels. Suppose the four small wheels to revolve upon the carriage axles; the four large ones must then be placed on axles above these, so that the outsides of the rims of the small may stand on the insides of the rims of the large wheels; these rims being made wide, and projecting inwards for that purpose. The large wheels are to be very loose upon their axles, in order to allow them to have very considerable play, that they may not bind with the small wheels. "The action of these wheels, thus applied," we are told, "will be that of one wheel," but we are still incredulous on this point. Some two or three years ago, a similar plan was proposed, and we believe patented, in England; it was described in the journals as a carriage to carry its own railway; the only difference in the two, is, that in the English plan nothing was said of the means of supporting the large wheel by a second axle, or of any other mode of keeping it in its place; probably, because the inventor perceived that this was a point of some difficulty, and he concluded, therefore, that it was best to allow the large wheel to take care of itself.

Without agitating the question of the theoretical utility of the thing upon a level road, let us suppose the large wheel to encounter an obstacle six inches in height; in this case the play upon the axis of the large wheel would be of but little avail, and if there would be no interlocking and interfering of the little and the big wheels, as they are compelled to *climb the hill together*, why then we are out in our judgment, which, like the invention itself, would be nothing new, as the one has frequently happened here, and the other has been proposed, and perhaps even tried, in England. To any one who is particularly desirous of 'making a noise in the world,' we apprehend that the patent double wheels, with plenty of play, would be very agreeable.

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21. For the application of *Steam to produce a Rotary Motion;* Joseph Mount, Nashville, Tennessee, July 16.

It would be in vain to attempt an explanation of the very complex machine above named. The arrangement of the parts has been a business of much thought, and the constructing of the machine would be one of much expense. The patentee claims "The whole arrange-

ment of the various parts, and bringing all the parts which require to be packed, into convenient situations to be packed, or tightened, without removing any parts of the engine, thereby removing the *greatest* difficulty which has attended the working of all former rotary engines."

We have repeatedly noticed the objections to rotary engines, and certainly one of them is the difficulty of packing, but still we do not think this the *greatest* difficulty. In most of the plans which have been proposed, a greater difficulty than packing, is, the obtaining in large machines the accuracy in form which they require, and the impossibility, in many parts, of making the packing a remedy for this defect, without producing an enormous portion of friction; these difficulties, we apprehend, are not removed. The *greatest*, however, has been, that, hitherto, with the same quantity of fuel, less power has been obtained from the rotary, than from the reciprocating engine, whilst, at the same time, it is more expensive.

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22. For a *Cooking Stove*, in which mineral coal, charcoal, or wood, may be employed; Ezekiel E. Bennet, Sandy Hill, Washington County, New York, July 17.

We are unable to tell in what particulars this stove differs from many others, excepting in its shape, and in some unimportant variations in the arrangement of its parts; the principal of these variations appear to be, the using of two grates, and the making the side and back plates to flare out, which increases the dimension of the upper parts of the stove. These are both claimed, together with various other particulars, as follows: "Having the insides and ends of the stoves in a position diverging from each other, from the bottom, upwards. In having narrow plates round the inside, on which the lower grate is to rest. In the use and location of the two grates. In having the front plate moveable. In having the upper plate moveable on hinges, so as to open or close that apartment of the stove. In the use and application of the tin oven. And in whatever else, either in form or principle of the thing itself, or of its application, use, or combination, the improvements described may be considered original."

The kind of sweeping claim with which the above concludes, is common in patents for those improvements which are scarcely visible or tangible; such claims, however, must be considered as useless, if not injurious: if they are mere surplusage, it would be better to leave them out; if they indicate any thing, it is that there is something intended to be claimed which is not set forth in the way that the law requires.

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23. For an improvement in the *Spring Seats for Wagons or Carriages;* Schuyler Reynolds, Northumberland, Saratoga County, New York, July 17.

The spring seat, which is the subject of this patent, is composed of slats of elastic wood, placed above each other in the following

manner. A quadrangular frame is made by taking two strips, say of two feet in length, to form the ends of the first frame, and two others of the length of the intended seat, which will be governed by the width of the wagon, or other vehicle. These are joined together at, or near, their corners, by placing the long above the short strips, and securing them by screws or rivets. A second similar frame is then made, but so much smaller than the former as to pass within it. Two strips, similar to the end pieces of the first frame, are to be placed parallel to them, and to each other, on the upper side of the front and back strips, but so near the middle of the frame as to be only four or five inches apart; these serve for the supports of the second frame. A third, fourth, or any other number of frames similarly formed and supported, constitute the spring part, upon which the ordinary seat is to be placed; the elastic frames being varied in length and width, so that they may pass within each other, without touching, in springing down. The frames and cross strips must be properly secured together, by any suitable means, such as rivets and burs, or screws and nuts. The claim is to the manner of arranging the strips.

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24. For a mode of *Refining all kinds of Oil,* and animal fat; Charles E. Ruggles, New York, July 20.

This being a process which may be performed in secret, and the right of the patentee thereby evaded, we do not publish it.

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25. For a mode of *Affixing and Applying Glass Chimneys,* similar to those used with the various kinds of Argand Lamps, *to the cork tops used with glass lamps;* Deming Jarves, Boston, Massachusetts, July 20.

The tops of the glass lamps in ordinary domestic use, consist of cork enclosed between two pieces of metal. To affix glass chimneys to these, three narrow strips of metal are to be soldered at equal distances apart, and radiating out from the upper plate; the ends of these pieces are to be bent up, and made to hook inwards, to receive and support the glass chimney. The lower edge of the glass has a rim, projecting outwards, by which it is to be held by the metallic hooks. In order to admit of fixing it in its place, a notch is left in the glass rim, which may then be placed under two of the hooks, with its notch over the third, when it is pressed down, and a small turn secures it.

This simple contrivance is certainly superior to the screw which is now frequently used to fasten the burners in their places, and which requiring to be screwed and unscrewed, is very liable to be out of order, and not unfrequently occasions the breaking of the glass.

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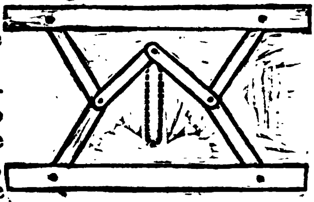
26. For a machine called the '*Power Press,*' *for Punching Copper, or other Metallic Plates,* for ships' use; George Darracott, Boston, Massachusetts, July 21.

This press is intended to punch, at once, all the holes required in a sheet of copper, or other metal. A strong frame of wood is secured together by bolts and screws; the upper timber of this frame, is about five feet long, fourteen inches wide, and six inches thick, the ends and bottom being of corresponding strength. Under this is a moveable piece, or follower, which is capable of being raised, by means of the progressive levers, or toggle joints, which are placed below it. This follower is, in the specification, denominated the plattin; it is about four feet seven inches long, thirteen inches wide, and six inches thick. These two timbers stand at about four inches apart. This space is occupied by two pieces of plank, each about two inches thick, and of the same length and width with the plattin; in the upper one are fixed as many punches as there are to be holes in the sheet, and in the lower one corresponding dies; a sheet of iron being placed between each plank, and its corresponding timber, to support the punches and dies.



The power is obtained by an arrangement of progressive levers similar to that shown in the margin; the middle joint being forced down by a lever, causes the plattin to rise, and the plate upon it to be perforated.

27. For an improvement in the *Manufacturing of Wool;* John Goulding, Dedham, Massachusetts, July 21.

Mr. Goulding has obtained some eight or ten patents for improvements in carding and spinning, most, if not the whole of which are so intimately connected together, that a view of the entire system would be necessary to the understanding of the separate parts. The present patent is for the manner in which he crosses the wool while delivering from the card, before it passes into the tubes described in some of his former patents.

28. For a *Machine for Printing*, styled the 'Typographer;' Wm. A. Burt, Washington, Macomb County, Michigan Territory, July 23.

We intend, hereafter, to publish either the specification, or a description of this invention, with engravings.

29. For a machine for *Manufacturing Wrought Nails and Screws;* Stephen I. Gold, Cornwall, Litchfield County, Connecticut, July 25.

The description of this machine is of considerable length, and not easily abridged, as it attempts to describe a machine consisting of many parts, in words alone, without reference to the drawing; nor is the latter sufficiently well executed to give a distinct view of the machine. Much pains has evidently been taken with the specification, the re-

sult of which evinces the necessity of referring, throughout, to descriptive drawings, for the purpose of clearly explaining complex machines.

There is no particular part of this machine claimed, the general arrangement being considered as new.

To a strong frame, is fixed an anvil, with its face downwards; in this face, grooves, or cavities, are formed, which are the counter parts of one-half of the nail, or screw, to be made. Under this a roller is made to pass, which has grooves to correspond with those on the face of the anvil. The thread of the screw is to be formed by this kind of operation, but, as the juncture of the moulds, or dies, would leave a ridge, the roller passes twice over it, the wire being turned one-quarter round between the two motions. The screws may be headed by methods heretofore used. The chisels which are to cut off the wires, or nail rods, are acted upon by levers, cranks, and hammers; the rods are kept in a fire, in numbers, without a blast, and two are to be passed in at one time.

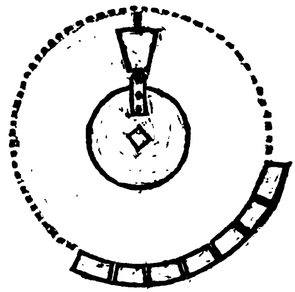
When a model is received, we may be able to form a better judgment of the whole, than can be done from the materials now before us; should it appear to merit a particular description with drawings, they shall be furnished.

30. For a compound for cleaning, biting, *Sharpening*, *and Polishing*, *old and worn out Files;* A. P. & E. Brittingham, New York, July 27.

The operation of sharpening old files, as the title indicates, is to be performed by biting, or acting on their surfaces, by acids. The specimens shown at the patent office, speak well for the process, as some files were exhibited, the teeth of which were sharp, although it was declared they had, previously to the operation, been completely dull. The patent is taken for the kinds, mixture, and proportion, of the acids employed.

31. For a *Thrashing Machine;* Calvin Emmons, New York, July 27.

Between this thrashing machine and many others which have been made, there is a perfect resemblance, with the exception of the manner of fixing the beaters by hinging, which we believe to be new; and this is the only part claimed by the patentee. The grain is to be laid upon a feeding apron, in the ordinary mode, and is carried forward to the beaters; of these there are to be from four to eight, furnished with rows of teeth; their length is governed by the width of the frame of the machine; their outer, or thicker edges, measure from 1½ to 2 inches, their inner edges, by which they are hinged to circular heads on the ends of the shaft, may be about half an inch in thickness; they may be hinged either with metal, or leather, the teeth from half an inch to an inch and a half in length. The circular box in which the beaters revolve, may have short teeth, or otherwise, as may be preferred.



The cut in the margin represents a section of the beater cylinder, with one of the beaters. The upper part, represented by a dotted line, is a circular case, or cover; the lower part, where the grain and straw pass, after being beaten, is formed of slats. The claim is to "the construction and application of the revolving toothed beaters, attached to the circular heads, of wood, or iron, by means of joints, or hinges, which prevent the machine from clogging, acting, or revolving, within the concave frame, and applied to thrashing all kinds of small grain."

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32. For an improved *Atmospheric Steam Engine;* James Mead and Milden Kitchell, Lebanon, Warren county, Ohio, July 27.

This steam engine, although denominated *Atmospheric* by the inventors, has but little title to the name, as it is proposed to work a double lifting, or forcing pump, by means of a double stroke steam cylinder. The whole contrivance is one of those frequent, but unfortunate, efforts made by persons of more ingenuity than skill or information. Instead of the condensor used in the Boulton and Watt engine, the pumps by which the water is to be raised, are to perform that office; for this purpose one eduction pipe leads from the upper escape valve into the body of one pump, and another from the lower valve into a second pump. It is calculated that the steam will be condensed, and a vacuum left, which will cause the atmosphere to keep it full of water to the height of thirty-three feet, when two pistons, worked by the beam of the steam engine, are to raise it higher.

The water, after being pumped up, is to fall upon a wheel, to drive machinery; after which, it returns to its original reservoir, to be again raised and to resume its labour. The mere fact of the purpose in view being to raise water by steam, to turn a wheel, renders comment unnecessary to those who have any claims to practical science, and we cannot spare time and room, at present, to write a *hornbook* for others.

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33. For an improvement in the construction of the *Ever Pointed Pencil Case;* William Johnson, Philadelphia, Pennsylvania, July 27.

The whole specification is as follows:—

"Specification of the slide for which the patent is craved.

"The slide is inserted in the pencil case; it is a circular wire, which, pressing against the sides of the case, acts as a spring to keep it in its proper place; this slide is pushed forward by a small pin connected with it, and projecting through the side of the case; the

wire entering the point of the pencil case, when pushed forward, propels the lead, and operates with the same effect as the screw now in use." WILLIAM JACKSON.

We have here just the old fashioned pencil case, the slide being used to push forward the lead alone, instead of the lead enclosed in wood. For ourselves, we so well like the gentle and regulated manner in which the screw causes the point to advance, as to be of opinion that it would be no improvement upon the beautiful case presented to us by Messrs. Woodward & Co. of New York, to substitute for it the old method of a slide, pushed forward by the hand.

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34. For a *Toothed Cylinder Pump;* E. Lazelle and D. Bloodgood, Poughkeepsie, Dutchess county, New York, July 27.

This pump consists of two metallic cylinders working within a metal box. The cylinders are to be toothed along their whole surface, are to match into, and turn, each other, like toothed wheels. They must fit exactly into the box in which they are contained, as the teeth must work water-tight, against its semicircular ends. The box is to be closed by two heads which fit exactly on the ends of the cylinders, and receive their gudgeons; one of which passes through the head for the purpose of having the crank attached to it, to work the pump. A pipe descends into the well, or reservoir, from the lower part of the box; and another pipe ascends from its upper side, through which the water is to be forced.

A pump very similar to this was patented in England, about three years since, by a Mr. Joseph Eve. The cylinders were worked by cog wheels upon their gudgeons, outside of the box; each of these cylinders had but two teeth, or wings, which were, consequently, more easily made to fit the box, and left a larger water way; that of the present patentee being only the space between the teeth of the cylinders. We should be glad to be able to give the preference to the pump of Messrs. Lazelle and Bloodgood, but, whilst the principle is evidently the same, the difficulty of making the latter, the difference of the water way, and the amount of friction, are all against it. We have not seen either at work, but the account given of Eve's pump was a very favourable one; it is stated that with "Cylinders 3½ inches diameter, by 6 inches long, and the wings only ¾ of an inch wide, two men turning the winches, raised 1100 lbs. of water to the height of 21 feet, in three minutes;" which considerably exceeds the power of the ordinary pump.

If a pump can be so constructed that a continued stream shall be made to flow up the shaft, instead of allowing the water to lose its momentum at every stroke, the advantage resulting will be very great. The accomplishment of this object has been frequently attempted, but the machines have either had too much friction, or were liable to get out of order, and have, consequently, been abandoned; we have not learned the final fate of Mr. Eve's invention.

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35. For a composition for *Curing the Tooth-ache,* preventing

the teeth from decay, removing the tartar, and curing rheumatic pains; Thomas White, Pees Township, Belmont county, Ohio, July 29.

When we encounter quack medicines, we almost regret the rule which we have adopted, not to publish processes, or recipes, without the consent of the patentee; but still, as we think the rule a good one, it must not be violated. The composition above referred to, consists of a number of stimulating articles, several of which, either alone, or in combination, have been frequently used to give temporary relief in cases of tooth-ache; such articles, for example, as camphorated brandy, laudanum, oil of peppermint, camphor, nitric acid, opodeldoc, Venice turpentine, and tar; all of which are to aid in curing those afflicted with tooth-ache, tartar, and rheumatism.

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36. For an improved method of *Breaking and Dressing Hemp and Flax;* Amos Salisbury and John C. Langdon, Troy, New York, July 29.

At page 129, we have published a specification of a patent obtained by the same gentlemen, for a similar purpose, in which the flutes of the rollers used for breaking were formed of slats secured at their ends into round pieces, or heads, fixed at each end of the rollers. In the machine now patented, the general arrangement bears some resemblance to the former, whilst in several particulars it is essentially different. The breakers consist of fluted rollers, of which there may be five pairs, which it is proposed to make of cast-iron; they may be about two feet in length, and about six inches in diameter; they are, however, to diminish in size, gradually, from the first to the last pair; thus the first pair may be $6\frac{1}{2}$ inches in diameter, the second $6\frac{3}{8}$, and so on to the fifth pair, which, on this scale, would be 6 inches. The upper part of the frame in which the rollers are sustained, is an inclined plane, so that each successive pair of rollers stand a little below the preceding pair. The first pair may have five flutes, leaving five ridges, or leaves, from end to end; each successive pair to be finer than the last, the fifth pair having fourteen flutes. The rollers are placed in pairs over each other; the flutes, or spaces, between the ridges, or leaves, are two or three times the width of the leaves, in order that there may be sufficient space for the hemp, or flax, which is to be broken, to pass between them, as they mash into each other. Each of the rollers is turned by a cog wheel upon its axis, which causes each leaf to stand in the centre of its corresponding flute. The material to be broken is delivered by a feeding apron to the first pair of rollers, and is at length received on another apron from the last pair. In addition to the breaking rollers, there is a pair, denominated flyers, which follow the last pair of breakers; these are wooden cylinders, each furnished with six strips of iron about $\frac{3}{4}$ inch wide, and $\frac{1}{8}$ inch thick, placed at equal distances apart, and extending from end to end; the strips mash between each other like the leaves of the breakers, the cylinders are moved with considerable velocity, which causes the strips to operate

so as partially to dress the hemp, or flax, before its delivery upon the receiving apron. To complete the dressing, two other pairs of rollers are to be used. The first pair may be cylinders of wood, of ten or twelve inches in diameter, and of any desired length; along these, straight strips of metal are to be placed, like those on the last described rollers, and between each of these, other strips which are to be indented, or toothed. These cylinders run horizontally together, the strips of one mashing between those of the other; and the broken hemp, or flax, held in, and managed by, the hand, is to be allowed to hang down between them, it being moved up and down as required. Two other cylinders, called adjusting cylinders, are placed beneath these; they are smaller in diameter than the former, stand immediately under them, and are intended to prevent the fibres from becoming tangled, adhering to, and passing round, the dressing rollers.

The claims are to the gearing of the rollers at each end, so as to give firmness and strength to their movement; to the arrangement by which the ridges are kept in the centres of the flutes on the corresponding rollers; to the successive diminution of the rollers, and the corresponding diminution in the size and depth of the flutes; to the dressing cylinders with straight and indented plates; to the adjusting cylinders, and to the manner and principle in which the whole are regulated and made to operate.

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37. For a mode of *Making Roofs for Buildings in Brick Yards, Tan Yards, Salt Yards, Sugar Manufactories,* and for all purposes requiring the sun and air, occasionally, and the ability to exclude rain, snow, &c.; Nathaniel Adams, Marlboro, Ulster county, New York, July 29.

The roof is to consist of leaves, or shutters, about four feet in width, which are to be hung to the plate, and ridge pole, upon pivots. When turned edgewise, they admit the sun and air, freely, and when flatwise, form a continued roof. Battens run down one edge, to close the joints when shut, and a strip is attached to each leaf, to hold it open, more or less, as may be required.

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38. For manufacturing the *Rims or Felloes of all kinds of Wheels* for wheel carriages, by steaming and bending the same; Merrit Blakeslee, Canaan, Litchfield county, Connecticut, July 29.

There is no formal claim in the specification of this patent, but the tenor of it renders it manifest that the intention of the patentee is to claim as his invention, the forming of the rims of wheels from a single piece, by bending; as, after describing a plan for bending on the outside of a circular mould, he observes that "it may be bent to the required form in various methods, and on, or within moulds."

Were fortune and the fates disposed to make bargains with us mortals, we would agree with the former to be able to keep our carriage for a term equal to that which has elapsed since we first saw

rims of this description, and willingly allow Atropos to cut the thread, when fortune claimed the vehicle.

A Mr. Viney obtained a patent in England for such wheels, more than forty years ago. They are mentioned under the article WHEEL, in Rees's Cyclopædia, and in many other works. Rees says, "Mr. Viny invented the process for bending timber into a circular form, practised for some time by Messrs. Jacob and Viny, and now continued by others." "By this mode of construction, the grain of the wood is kept parallel throughout, so that the periphery of the wheel is equally strong," &c. &c.

Some persons appear to think that the obtaining of a patent for an old affair, will have the effect of making it young again, but we apprehend it will be found that our courts and jurors are of a different opinion: were such indeed the fact, all our old men and women would apply to be patented, and the business of the patent office would soon become overwhelming.

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39. For a "General Specific for the *Cure of the Tooth-ache;*" Samuel Pennington, Mount Pleasant, Jefferson county, Ohio, July 30.

Our fellow citizens of Ohio, have now a double chance of having the tooth-ache cured, or rather suspended, without the application of cold steel. Tar, whiskey, French brandy, spirits of turpentine, and Indian turnip, will effect it in the hands of Mr. Pennington, and if not, they may try Mr. White, (No. 35,) and after all, may resort to the dentist and the Dutch claw, which is the true *specific.*

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40. For an improvement in the *Dry Dock,* being a new method of taking ships, and other vessels, out of the water; Elias Selden, Haddam, Middlesex county, Connecticut, July 30.

This *new* dry dock is constructed exactly like a common lock upon a canal, for raising boats from one level to another, and exactly as it has been repeatedly proposed to construct dry docks.

A dock is to be prepared, into which the vessel can be floated; it is then to be enclosed by gates; water is then to be pumped in, or to be supplied, from any convenient source, to float the vessel into a second dock, which must be sufficiently elevated to allow the water to run off, and leave it dry.

There is, in the specification, a particular account of lengths, widths, mortises, tenons, number of pieces, and various other things respecting the timber to be used; and according to the description, and the mere scratch which accompanies it as a drawing, it appears to be the design of the patentee to form his dry dock above ground, by framing timbers together, and planking them. It is much to be apprehended that his scheme, his dock we mean, would not "hold water," in which case a vessel would be in no danger of finding its way into this aerial establishment.

41. For a *Mode of Drawing Lotteries;* D. Malcolm, New Orleans, July 30.

Patents have been obtained by Messrs. Yates and M'Intyre, Mr. Cohen, and others, for modes of drawing lotteries by combinations of different kinds. Mr. Malcolm's plan differs from these in its enabling him to draw any number in the entire series, of which the blanks and prizes may consist, by putting a comparatively small number of tickets into his wheels. It is not thought necessary here to detail the particulars of the plan, but merely to give a general idea of it. There are to be three wheels; into two of them, numbers are put; into the third, the prizes, and from each of these wheels tickets are to be drawn simultaneously. Suppose the number 120 to be drawn from the first wheel, and the number 99, to be drawn from the second; these placed together, give the number 12,099, to which appertains the prize which was drawn at the same time with the numbers.

The claim is to "the combining of numbers drawn from two, or more, wheels, in such a way, that by putting a comparatively small number of billets into the wheels, any one number upon the whole series of tickets of which the class consists, may actually be drawn against either of the prizes in the prize wheel."

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42. For an improvement in the machinery for the *Manufacture of Grain into Flour*, or meal; William Parkinson, Ohio county, Virginia, July 31.

A number of patents have been obtained for grist mills with small stones; the mill above mentioned is of this kind, the stones being from eighteen to twenty-two inches in diameter, and the upper one is to be the runner. The manner of fixing the spindle, the balance rine, and several other parts, together with the form given to them, are particularly described, but the section given in the drawing is too small to admit of their representation, and it is entirely without written references. The upper stone is to be forced down by a screw passing through a crosstree above its centre; the point of this screw is steeled, and enters into a socket which is also steeled, and which contains oil. A spring of sufficient strength is so placed as to support the runner, and prevent its grinding against the bed stone when the mill is empty; the screw is used to force it down, and regulate its feed. The grain is to be carried low down into the eye of the runner, by means of a tube, that it may not be thrown out by the velocity of its motion, which is to be equal to about 360 revolutions in a minute.

The claims are to the formation of the husk which supports the stones; the running of the upper stone when confined by pressure; the figure of the balance rine, and its connexion with the spindle and driver; the pressure rod and screw, for forcing the upper stone down; the spring under the bridge-tree for sustaining it, and the tube for conducting the grain to the lower part of the eye.

Specifications of American Patents.

Specification of a patent for an Improvement in the Rail-Road, and a Car adapted to run thereon, by means of which, roads, either curved or straight, are passed with equal facility. Granted to James Wright, *Columbia, Lancaster County, Pennsylvania, April* 17, 1829.

The improvement in the car consists in the construction of the wheels, which are so formed, that each wheel has two, three, or more rims of different diameters, with shoulders which serve as flanches, to keep the wheel upon the rail. The number of rims will depend upon the number of different curves in the different parts of the road. Where the curves are all of the same radius, two rims only will be required to each wheel. When the car, or carriage, runs upon a straight road, rims of equal diameters run upon the rails; when upon a curved road, the diameters of the rims employed, are, to each other, as the radii of the inner and the outer rails.

When the carriage leaves a curved for a straight road, a straight for a curved road, or one curve for another, the rails, at their places of meeting, do not form a continued line, nor are they on the same plane, a lateral offset being made, so that the rims of the proper diameters may take upon the new section, either straight or curved, upon which they are to pass. The difference in the elevation of the rails, is also made to correspond with the difference in the diameters of the rims, so that the wheels pass from one rail to another, without any jolt, or variation in the horizontal position of their axes.

What I claim as new is the whole of the arrangement herein described, by which the rims of different diameters upon the same wheel are adapted to pass upon rails, either straight or of different curvatures, and the laying of the rails in the manner described, so as to correspond with the structure of the wheels, without regard to the manner in which the carriage, or the road, is formed in other respects.

James Wright.

References to the drawing, Plate 3. *Fig.* 1.

A, the car, each wheel of which has flanches, and rims which are of different diameters.

B, B, the higher rails, which receive the rims of the smaller diameter; these rails are always on the inner line of the circle to be traversed.

C, C, the lower rails, which always bear the wheels in their full size.

Specification of a patent for an improvement on the Rail-Road, by which a Rail-way Carriage may be made to turn out and in at the places intended for that purpose, on a single rail-way; or to pass from one track to the other where the road is double; which mode obviates the difficulties heretofore experienced in effecting this object. Granted to James Wright, *Columbia, Lancaster County, Pennsylvania, June* 11*th*, 1829.

The rail-road carriage which I use, and the kind of rail upon which it runs, are fully described in the specification which I deposited in the patent office of the United States, and for which letters patent were granted unto me, bearing date the seventeenth day of April, one thousand eight hundred and twenty-nine, to which instrument, with the drawings which accompany the same, reference may be had, for the purpose of more clearly understanding the addition to, or improvement upon, the same, which I am now about to describe.

For the purpose of rendering this description clear, I deem it best to refer throughout to the accompanying drawings; that marked Fig. 2, Plate 3, representing a single track, with its turning-out place, and that marked Fig. 3, a double track, with the rails for passing from one to the other. In each of these drawings the same letters refer to corresponding parts. The rails marked A, A, are those upon which the rims of the wheels run which are of the larger diameter, and are, therefore, those which have the lesser elevation; those marked B, B, and which are shaded, are the more elevated rails, upon which the rims run that are of the smaller diameter. Those parts, C, C, that are left blank at the junction of the rails, are openings for the passage of the flanches of the wheels; these openings will not be of such a width as to present any sensible obstruction in the passage of the wheels over them.

It may sometimes be found useful, and I intend, occasionally, to apply a small thin piece of curved rail, of wrought iron or other material, at the commencement of the turn-out, which, when in its place, shall raise the higher rail sufficiently to prevent the larger rim from touching the lower rail, and which will necessarily have the effect of compelling the car to follow the curve; when this is out of its place, the rim of the smaller diameter will not touch the higher rail, and the car will consequently proceed straight forward. Pieces so used may be fixed upon a pivot, or hinge, in a way so simple that it is unnecessary further to describe it.

It will be seen by inspection that the higher rail does not, in any instance, cross the main road, but only occupies the space between the two roads, or tracks, or form one of the rails of the turn-out on the single track, and that the space left for the flanch to pass is always in the lower rail.

By the adoption of the foregoing plan, much of the expense heretofore encountered in constructing turn-out places, will be avoided,

as the distance to which they must extend will be very considerably decreased.

Any friction wheel, applicable to rail-way carriages of any other construction, may be applied to my carriage, constructed to operate on a straight or curved road.

What I claim as my own invention in the above described plan, is the whole arrangement of the rails of greater or lesser elevation, to my rail-road carriage, each wheel of which has rims of different diameters, so as to effect the purpose of turning out, and in, upon a rail-road.

JAMES WRIGHT.

Specification of a patent for a new and improved mode of causing Rail-way Carriages to run with equal facility on straight or curved roads; denominated the Self-adapting Rail-way Carriage, or Car. Granted to JAMES WRIGHT, *Columbia, Lancaster County, Pennsylvania, September* 10.

BE it known, that I, James Wright, of Columbia, in the County of Lancaster, and State of Pennsylvania, have invented a new and improved mode of causing rail-way carriages to run with equal facility upon straight or curved roads; which carriage, or car, so constructed, I denominate the SELF-ADAPTING RAIL-WAY CARRIAGE, OR CAR; and that the following is a full and exact description of my said improvement.

The wheels are firmly fixed upon the axles of the carriage; the axles turning in suitable boxes, or against friction wheels, constructed in any of the modes already known. The bearings in which the axles run, are attached to the frame work of the carriage, by a bolt, or pin, in their centres, in order to admit of such a degree of motion, or vibration, on these centres, as shall allow of the fore and hind wheels adapting themselves to the curvature of a road, by their planes forming a tangent to the curve of the rail upon which they are to run.

The wheels have each one flanch, and their edges, which run upon the rail, are in the form of the frustum of a cone, the flanch being upon the side of largest diameter, which usually stands within the rail, but it may be placed on the outside, without, in any way, varying the principle upon which it is to operate.

The angle which the edge of the wheel forms with its plane, may admit of considerable variation, and may be governed by the radius of the smallest curvature over which the carriage is to pass; as for example, should the curvature be upon a radius of three hundred feet, the angle will vary more from ninety degrees, than would be necessary for a curvature of six hundred feet. In every case the obliquity must be such, that in running upon the rails, a circumference shall be found upon the conical surfaces of the wheels, which shall adapt them to the running, without friction, upon each of the curved rails.

The kind of rail which I would prefer as best adapted to my im-

proved carriage, is the round topped rail; but any of the rails in ordinary use may be employed.

When a carriage, constructed in the manner above described, is placed upon a rail-road, it will be found that it has a tendency to adjust itself, and actually will adjust itself, so as to give to the wheels the positions necessary for running upon a road, either straight or curved, with no other than the ordinary rolling friction.

What I claim as new, and for which I ask an exclusive privilege, is the conical form of the edges of the wheels, and the vibratory motion of the axle, to allow of the wheels adapting themselves to the curvature of the rails.

Where, in any particular part of a road, it is desired to turn upon a smaller curve, than might be thought convenient by the foregoing plan, the addition of a rim may be made to the wheels, to operate upon an elevated rail, upon the principle described by me in the specification of a rail-way, and cars to run thereon, for which a patent was granted to me on the 17th day of April, 1829.

JAMES WRIGHT.

In the annexed drawing, Fig. 1 represents the plan of the carriage; and Fig. 2, the connexion of the axle with the carriage by means of a pin through its frame, and the frame in which the axle turns. Between the two frames friction wheels, or rollers, may be placed to sustain the load, and allow the axle to vibrate freely.

Fig. 1.

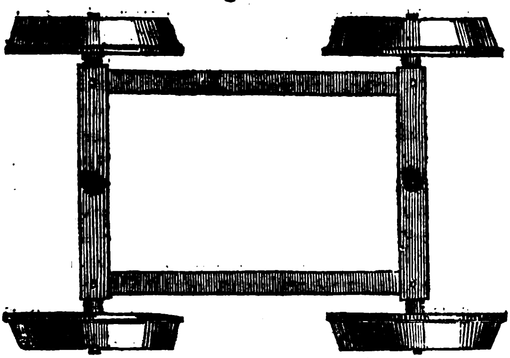
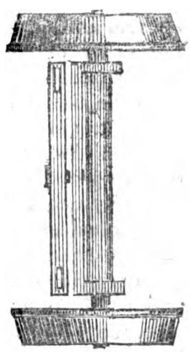


Fig. 2.



Specification of a patent for an improvement in the application of the Scape-heat from the high pressure Steam Engine, for which a patent was obtained October 30th, 1827; ALEXANDER BROWN, *Salina, Onondaga County, New York, June 11th,* 1829.

WHEREAS, Alexander Brown did, on the thirtieth day of October, one thousand eight hundred and twenty-seven, procure letters patent for a new and useful improvement in the application of the

scape-heat from the furnace, and the discharged steam from the engine of the ordinary high pressure steam engine, to the manufacturing of coarse salt from salt water; and which letters patent contain a description, or specification, of said improvement as follows; that is to say:—"When the ordinary high pressure steam engine is in operation, much of the heat from the fire in the furnace necessarily escapes through the furnace chimney, and most of the steam generated in the boiler, after performing its operation in the engine, is discharged from the engine. For the purpose of applying that scape-heat and discharged steam to the manufacturing of coarse salt from salt water, the ordinary high pressure steam engine is located in some convenient place. An ordinary salt water vat is erected, from plank or other material, of any given dimensions; say fifty feet by fifteen feet, and two feet deep, and placed on a level, as near as may be, with the bottom of the furnace of the steam engine, and at a short and suitable distance therefrom. The scape-heat and smoke, instead of being permitted to pass through and out of the chimney immediately connected with the furnace, are conducted by means of a metallic cylinder attached, one end thereof, to the furnace, and placed horizontally through the vat, and the other end thereof in a chimney erected on the outer, and the opposite side of the vat, from the furnace; which vat being filled with salt water, sufficient, at least, to cover the cylinder, receives the heat from the cylinder. A second cylinder, for distinction termed the steam cylinder, is also placed horizontally through the aforesaid vat, and one end thereof united to that part of the steam engine which discharges the steam from the engine, and of sufficient dimensions to convey the steam freely, and the other end on the outer and opposite side of the vat. This steam cylinder conveys the heat from the discharged steam, to the water in the vat, and conducts the discharged steam, or the water, should the steam in the cylinder be condensed, and discharges the same on the outside of the vat. The heat imparted from the cylinders to the salt water in the vat will cause an evaporation, and as the salt water contains in solution, besides the salt, some impurities having less affinity for the water than the salt, these settle after the salt water is evaporated to saturation. For the purpose of freeing the salt from those impurities, a second vat, of similar material and equal dimensions with the first, called the crystallizing vat, is erected and placed near the first vat, and sufficiently low to permit the water from the first vat to run into the second. The water in the first vat, after it is saturated, and all the impurities have settled, is drawn off into the second vat, and the steam cylinder is continued through the second vat, and which will impart to the saturated water in that vat, heat sufficient to keep up an evaporation for crystallization, and produce the finest and purest of coarse salt.

"This improvement does not consist in any of the machinery of the high pressure steam engine, nor in the conducting heat or steam through salt water by means of metallic cylinders, nor in any particular formation, or location of the vats, but only in the application of the scape-heat and discharged steam, by means of the aforesaid

apparatus to the manufacturing of coarse salt from salt water, thereby saving that heat which is usually lost, and applying that steam which is, ordinarily, used only to heat the water in the feeder for the boiler, and as a very small proportion is adequate for that purpose, so much may still be used by permitting the steam cylinder to pass through the feeder. Thus the scape-heat and discharged steam are applied to a useful and profitable purpose, without impairing the power of the steam engine, or diverting it from its destined operation.

And whereas, also, the said Alexander Brown hath, by experiment, discovered and established some material improvements on said patent: now therefore the said Alexander Brown is desirous that the said improvements may be patented to him, of which improvements the following is the specification.

The scape-heat from the furnace, instead of being conducted through a metallic cylinder, as in the aforesaid specification mentioned, is applied to a common sheet iron pan of any given dimensions, say twelve feet square and two feet deep, and which pan is placed between the furnace and the chimney, and with sufficient elevation to permit the heat and smoke from the furnace to pass freely, and not obstruct the draught of the furnace. This pan is used for heating the water which feeds the boiler of the steam engine, and is, for distinction, called the feeder. Salt water from the fountain may be put into the feeder, so that the boiler will be supplied with salt water instead of fresh water, and thereby the salt water in the boiler will be reduced to a state of saturation, or very nearly so. And in case the boiler is supplied with salt water, a discharging valve is placed in the boiler at some convenient place, and as near the bottom thereof as may be; and by which valve the water in the boiler, when saturated, is discharged, to prevent the forming of salt or the settling of the impurities in the boiler. The discharged saturated water is conducted from the discharging valve by a suitable conductor of wood or other material to the settling vat, in the aforesaid specification mentioned; and which settling vat, instead of being placed between the furnace and the chimney, as in the aforesaid specification mentioned, is placed in some other and convenient place, and as near the boiler and crystallizing vat, in the aforesaid specification mentioned, as may be, and of a proper elevation to receive the saturated water discharged from the boiler, and to permit it to run into the crystallizing vat. And the conducting of the water thereafter is the same as in the aforesaid specification mentioned.

And also for the purpose of manufacturing fine salt, the crystallizing vat in said specification mentioned may be used; but to enable the manufacturer to make both coarse and fine salt at the same time, a third vat is made of any given dimensions, say the same as the said crystallizing vat, and of the same material, and placed as near to the said crystallizing vat as may be, and sufficiently low to permit the water from the said crystallizing vat to run into the said third vat, through which the steam conductor also is passed, and which third vat, for

distinction, is called the fine salt vat; the saturated water is drawn from the crystallizing vat into the fine salt vat, and over the top of the fine salt vat, and as near the surface of the water therein as may be, is passed a conductor of wood, or tin, or other material, of about two inches in diameter, and conducted back and forth across the said vat, at about three feet apart, and the underside of which conductor, at about every three feet, has a small hole perforated therein of about the size of an ordinary nail gimblet, and which conductor, for distinction, is called the air conductor; one end of the air conductor is attached to an ordinary air furnace pump, or bellows, and which air pump or bellows is attached to, and carried by the steam engine. And when the steam engine is in operation, the said air pump, or bellows, causes a constant current of air to pass in the air conductor, and out of the small holes so perforated therein as aforesaid, and blows upon the surface of the water, and thereby causes the evaporation, in a given time, to be more rapid, and by agitating the surface of the water in the fine salt vat, prevents its crystallizing, and the salt settles at the bottom of the vat, and is fine and of a superior quality.

These improvements consist, principally, and materially, in two things, to wit:—

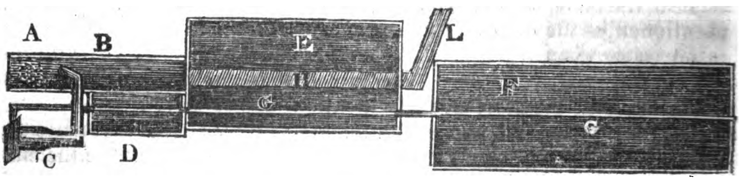
First—In using salt water in the boiler of the steam engine, instead of fresh water, and thereby causing a direct application of the heat applied to the boiler, to the evaporation of the salt water, and saturating the same in the boiler, or as near as may be, before it is vented and conducted into the settling vat.

Secondly—In the application of a current of air acting upon the surface of water in the fine salt vat, and thereby accelerating the evaporation, and producing a superior quality of fine salt.

These improvements, as far as they embrace the machinery and apparatus herein before specified, or mentioned, are not desired to be patented, but only the application of them, and the manner and effect of using them. The power required to carry the air pump, or bellows, will be trifling, and not much divert or impair the power of the steam engine.

ALEXANDER BROWN.

Fig. 1.



Description of the Drawings.

Fig. 1, is the apparatus under the old patent.
Fig. 2, the improvements in the present patent.
A, A, the mouths of the furnaces,
B, B, the boilers.
C, C, parts of the steam engine.

D, D, the feeder in the old patent, and sheet iron pan and feeder, in the improvements.

E, E, the settling vats.

F, F, the crystallizing vats.

G, G, the steam conductors.

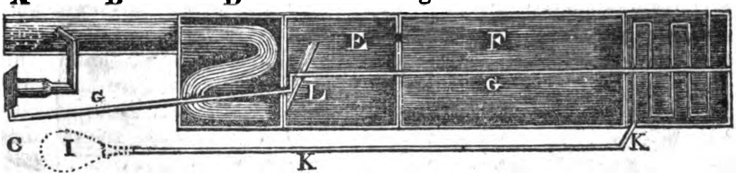
H, the metallic cylinder.

I, the air pump, or bellows.

K, the air conductor.

L, L, the chimneys.

Fig. 2.

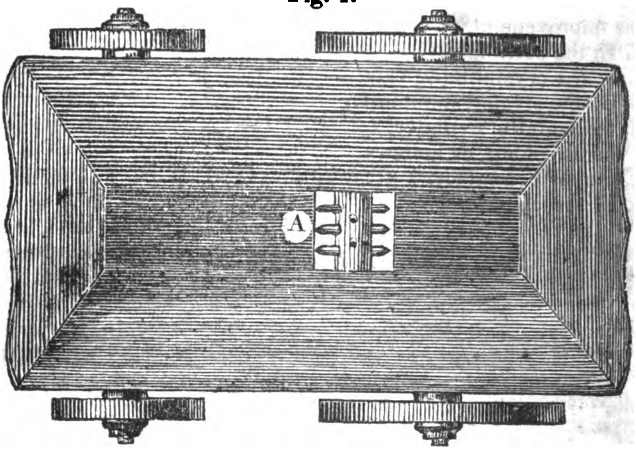


Description of a machine for scattering manure upon land, by means of a 'Manuring Wagon,' patented by James Bowman, *Beaufort, South Carolina, August 12th,* 1829.

Every agriculturist is aware of the immense labour attending this process, as it is ordinarily performed; a labour so great as frequently to prevent its being undertaken, notwithstanding the manure may be at command. The scattering, when done by hand, is generally very irregular, the consequences of which are plainly to be seen in the unequal growth of the crop, as vegetation advances. These difficulties have been completely obviated by the invention of Mr. Bowman, who has satisfactorily tested the value of his machine, before applying for a patent; the facility, rapidity, and perfection with which it acts, not only excited the admiration of a number of intelligent planters in his immediate neighbourhood, who witnessed it, but far exceeded his own expectations. The plan was undertaken without the most remote idea of obtaining a patent, which was suggested only by the excellence of the instrument itself.

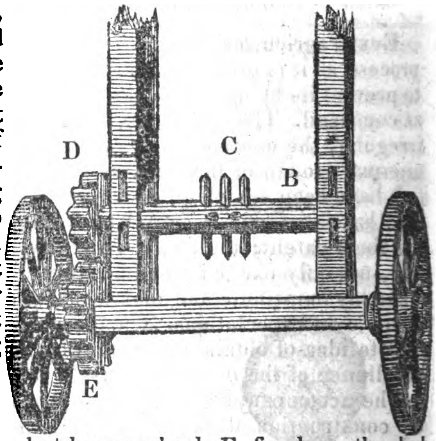
The accompanying engravings will afford a very correct idea of the construction of the wagon, and the apparatus for scattering the manure. Fig. 1, gives a bird's eye view of the body of the wagon, which is of the size commonly used for agricultural purposes. Its sides are inclined planes, meeting the bottom at an obtuse angle. In the bottom, near the hinder axle, there is an opening made, as seen at A, of about two feet in length, and eighteen inches in width.

Fig. 1.



Through this opening the manure is to pass, as it is scattered by the machinery seen in Fig. 2, which represents the hinder part of the frame of the wagon to which it is attached.

Fig. 2.



B is a revolving shaft, usually made square, and which crosses the bed of the wagon at a short distance from the axle. This shaft carries ten pins, made of iron, or of any other suitable material, and extending out a sufficient length to occupy the aperture left in the bottom of the wagon, but without touching its sides or edges. These are seen at C, and also in the opening at Fig. 1.

Upon the end of the shaft, there is a cog-wheel, D, which is turned by a similar, but larger wheel, E, fixed on the hub of one of the hind wheels; and, of course, when the wagon is drawn forward, the shaft will revolve, and the manure be scattered. Mortise holes are represented upon the frame, on each side of the shafts; these are to receive wedges, by means of which the shaft may be thrown in or out of gear. An ordinary hand can drive the wagon, and shovel the manure towards the opening, and in this way perform the labour of several strong and able men.

FRANKLIN INSTITUTE.

Monthly Meeting.

A Stated Monthly Meeting of the Institute was held at their Hall, September 24, 1829.

Mr. S. J. Robbins was called to the chair, and William Hamilton was appointed Secretary, pro tem.

The minutes of the last meeting were read and approved.

The following donations were made to the library and cabinet of minerals, viz. Nicholson's Practical Builder, in seventeen parts; and Nicholson's New Carpenter's Guide; presented by Mr. J. G. Yatman. Bigelow's Elements of Technology; presented by Hilliard, Gray & Co. Two Addresses, delivered before the American Institute, July 4, 1828, and July 4, 1829. Three Reports of Committees to the American Institute; presented by the American Institute of New York. *Instructions, Théorique et Pratique Sur les Brevets D'Invention. Exposition D'un Nouveau Systeme de Perspective*; presented by J. G. V. De Moléon. Several Specimens of Minerals from Massachusetts; presented by W. R. Johnson.

The Corresponding Secretary also presented the following Mechanical and Scientific Journals, received in exchange for the Journal of the Institute:—London Journal of Arts and Sciences for August, 1829; London Register of Arts, and Journal of Patent Inventions, for August, 1829; Gill's Technological and Microscopic Repository for August, 1829; *Annales des Mines*, Vol. 4, No. 6, and Vol. 5, No. 1; *Annales de Chimie et de Physique* for March and April, 1829; *Bulletin de la Société D'Encouragement pour L'Industrie Nationale*, for March and April, 1829; *Journal des Connoissance Usuelles et Pratiques* for June, 1829; *Recuiil Industriel, Manufacturier, Agricole et Commercial*, for April, 1829; *Bibliothéque Physico-économique* for June, 1821.

The Committee on Inventions presented reports on the following inventions and improvements submitted to them for examination, by the inventors, viz. On a Compound Protractor, by Ennion Williams, of Philadelphia. On a Combined and Rotary Protractor. On a machine for ascertaining and marking, in a profile form, the Soundings of Coasts, Bays and Harbours, by Ebenezer Cooley, M. D. On an improved Rail-road Car, by Mr. James Wright, of Columbia, Pennsylvania. On an improvement in Locomotive Engines, by W. R. Hopkins, of Albany, New York.

The Corresponding Secretary, Dr. Hays, communicated to the meeting letters from J. G. V. De Moléon, Chief Engineer of the Domains of France; from the Franklin Institute of Rochester, New York; from the Maclurian Lyceum of Science of Philadelphia; and two from the American Institute of New York.

W. R. Johnson submitted for examination two modifications of apparatus for igniting spongy platina, by hydrogen gas, on which apparatus some observations were offered.

The following queries were submitted for discussion, which were read, and laid on the table, viz.

1st. What is the best construction of Barker's mill, and what its maximum effect?

2nd. What is the true mode of computing the power of high pressure steam engines?

3d. What is the proper height of a carriage wheel, with an axis of a given diameter, in order to be most efficacious in aiding the draught of horses in transportation?

4th. What is the absolute centrifugal force of a body revolving in a circle of a given diameter *d*, with a given velocity *v*?

5th. What is the rationale of the action of hydrogen gas on spongy platina, as discovered by Doëbereiner?

6th. Which will move down an inclined plane with the greatest velocity, a wheel of two, or one of four feet in diameter, supposing their weights the same, and the matter of each to be all disposed around in its periphery?

(Extract from the Minutes.)

S. J. Robbins, *Chairman.*

W. Hamilton, *Secretary, pro tem.*

TO THE FRANKLIN INSTITUTE.

The following is submitted as an answer to some of the questions formerly proposed for discussion.

Very respectfully,

Charles Potts.

August 17*th*, 1829.

Quest. What shaped aperture will deliver the greatest quantity of water in a given time and under a given head?

The obvious extent and importance of this question, has called forward many of the most celebrated philosophers and mathematicians to its investigation. Numerous and diversified experiments have been instituted, from some of which I shall endeavour to select such practical results as have been obtained, and which seem most likely to answer to the conditions of the question.

In the discharge of water through simple apertures, either in the sides or bottom of a reservoir, it is evident that with respect to the resistance which tends to diminish the full or natural discharge, we can have very little doubt whether the shape of the aperture ought, in order to present the least rubbing surface, to be square, triangular, or otherwise, since we know that of all equal areas, the circle has the least peremiter or circumference. Hence, if we suppose the water to be discharged through an orifice made in a thin plate, that discharge will be the greatest when the aperture has a circular form. The experiments of Bossut confirm this conclusion in a very satisfactory manner.

This might be submitted as a full answer to the question, were we to limit it to the phraseology of its expression: but as I conceive not only apertures, but also such contrivances as are denominated *adjutages*, from their property of promoting the discharge of water, to be implied in the question, I shall extend the inquiry on this construction.

Newton first noticed that running water delivered through apertures did not preserve an equal section, but that the column after leaving the aperture gradually decreased in thickness for a distance about equal to the diameter of the orifice, after which it increased. This contraction of the effluent stream, which is evidently owing to the filaments of water in the reservoir being drawn towards the aperture by forces acting in different directions, is what demands particular attention, inasmuch as the proper shape of the adjutage called for in the proposition is found to depend upon it.

One of the primary objects in the experimental researches of Bossut and Michellotti, was to determine the different effects of this contraction under different circumstances. Michellotti, after carefully examining the form which the water naturally assumed in its effluent state, determined the figure or shape of that part of the natural jet between the vena contracta and the reservoir, to be that formed by the revolution of the trochoid (cycloid) around the axis of the jet, with dimensions having the following ratio.

Diameter of the outer orifice (vena contracta)		= 36.
Do.	inner	= 46.
Length of the axis		= 96.

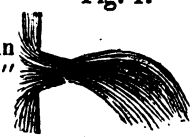
The effect of this adjutage was such as to give a discharge of 983 when the natural discharge would have been 1000.

According to the results deduced by Eytelwein, a conical tube approaching to the figure of the contracted vein produced a discharge equal to .98 of the full velocity, which agrees in a striking manner with the preceding.

With the view of showing more fully the effect of short tubes on the discharge of water, and also of drawing a comparison with the above mentioned adjutage, I shall quote the results of several experiments instituted by professor Venturi on this head. These experiments are considered highly important in practical hydraulics.

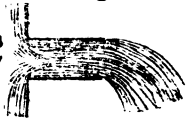
The same quantity of water, 4.845 English cubic feet, flowed out of the same vessel, which was kept constantly full, through the following adjutages, in the time annexed, which is expressed in seconds. The altitude of the water above the centre of the aperture of the adjutage was always equal to 34.642 English inches.

Fig. 1.



Through a simple circular aperture, Fig. 1, in a thin plate, diameter = 1.6 inches, in 41."

Fig. 2.



Through a cylindrical tube, Fig. 2, diameter as above, and 4.8 inches long, in 31.″

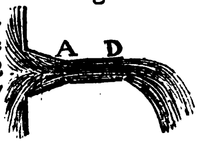
Fig. 3.

Through the tube, Fig. 3, which differs from the preceding in being contracted in the middle, in 31.″

Fig. 4.

Through the short conical adjutage, Fig. 4, which is only the first part of the preceding, in 42.″

Fig. 5.

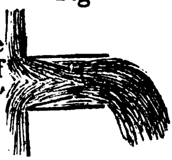


Through the pipe, Fig. 5, which consists of a cylindrical tube adapted to the small end of the above, and of the same diameter, AD being 3.2 inches long, in 42.5.″

Through a like adjutage, but longer, AD being 12.8 inches, in 45.″

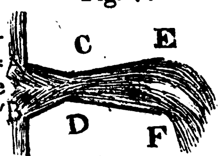
Through the like, AD being 25.6 inches, in 48.″

Fig. 6.



Through an adjutage, Fig. 6, consisting of the simple tube, Fig. 2, placed over the conical part of Fig. 4, in 32.5.″

Fig. 7.



Through the double cone, Fig. 7, the dimensions of which AB = EF = 1.6 inches, AC = 0.977 inches, CD = 1.376 inches, and the length of outer cone = 4.351 inches, in 27.5.″

Fig. 8.

Through the adjutage, Fig. 8, consisting of a cylindrical tube 3.2 inches long and 1.376 inches in diameter interposed between the two conical parts of the preceding, in 28.5.″

From these experiments, it appears that the effect of the double coned adjutage, Fig. 6, which was the best in these experiments, was

such as to increase the discharge through the simple circular aperture about *one-third.* This adjutage, however, does not equal that found by Michellotti. For, we have the time in which the quantity of water answering to this case would have been discharged by theory equal 25.5." Hence, the effect of this adjutage gives a discharge of only .92 of the full velocity, whereas that found by Michellotti, as has been observed, is .983.

From the experiments of Venturi, we further observed that the velocity of the water through a simple conical adjutage was considerably augmented by the addition of another similar tube; hence the inquiry might be suggested, whether the adjutage as determined by Michellotti, might not be improved by the addition of a small tube beyond the vena contracta. This question, however, and many others appertaining to this subject, I have no doubt will shortly be satisfactorily solved by this Institute.

Quest. Will a double velocity of water, when the quantity is given, produce more than a double effect?

This question is easily answered in the negative; for it is evident that as the momentum or effect is as the quantity of water and its velocity directly; when the velocity is doubled the effect will be doubled *only.* This question is analogous to the one preceding, relating to the double impulse, which has already been answered by a member at the last meeting.

Quest. Does the production of a rotary, from a rectiliner motion, by means of a crank, involve a loss of power?

The simplicity of the crank, as the means of changing the rectilinear into that of a rotary motion, and vice versa, is much in its favour. It is, however, as will be shown in the sequel, an unprofitable servant, particularly when it is desirable to economize power.

Suppose the rectilinear force to be directed towards the centre of the shaft whereon the crank is fixed, which is the most ordinary relation between the two motions; and, that the rectilinear force is transmitted to the crank by a connecting rod. It is evident that in the progress of motion, the connecting rod and crank form all possible angles with each other in the period of each revolution. Hence it must be obvious, from a well known law in mechanics, viz. "that the force or energy of action is as the sine of the angle of incidence," that the power which is transmitted to the crank must be extremely variable. Thus, when the crank and connecting rod are in the same right line, the rectilinear force has no tendency whatever to turn the crank; this occurs twice in every revolution, viz. when the crank is on the centres.

When the crank, however, has made the least angle with the connecting rod, the force or energy begins to operate on the crank to turn it round, and to increase, as the angle formed by the crank and connecting rod decreases, until they make a right angle, or the connecting rod becomes a tangent to the crank's revolution, at which place the effective force transmitted to the crank becomes a maximum, or the greatest possible. But even here we may observe, when

the rectilinear force is applied as in the supposition, the whole of the energy is not transmitted to the crank (inasmuch as the direction of the rectilinear force does not fall perpendicular on the crank at the same moment) but approximates to it as the ratio between the lengths of the crank and connecting rod is increased. Hence the advantage of long connecting rods.

With the view of exhibiting more clearly the variability of the force exerted by the crank, I shall assume the following proportions as existing between the parts of the engine. Length of the connecting rod equal 3, that of the crank equal $\frac{1}{2}$. If, now, we represent the measure of the rectilinear force by unity, we shall have the effective force transmitted to the crank during the period of one revolution, as in the following table, commencing from that point when the connecting rod and crank form one extended right line.

From this table, which is sufficiently accurate for the purpose of comparison, we have the average force transmitted to the crank equal to $\frac{62}{100}$ of the rectilinear force, hence it follows, that the production of a rotary from a rectilinear motion, by means of a crank, involves a loss equal to $\frac{2}{5}$ of the power.

TABLE.

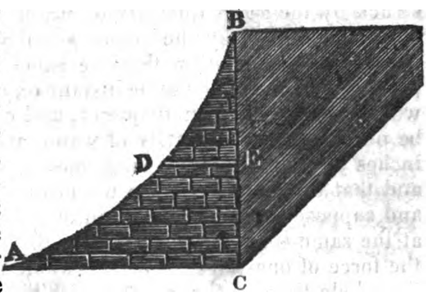
When the crank has moved. Degrees.	*The angle made by con. rod and crank.* Deg.	min.	*Effective force of the crank.* Decimals.
0.	180.	00	.0000
10.	168.	20	.1736
20.	156.	40	.3420
30.	145.	14	.5000
40.	133.	51	.6428
50.	122.	40	.7660
60.	111.	42	.8660
70.	101.	00	.9396
80.	90.	33	.9848
80. 24′	90.	00	.9863
90.	80.	25	.9860
100.	70.	33	.9848
110.	61.	00	.9396
120.	51.	42	.8660
130.	42.	40	.7660
140.	33.	51	.6428
150.	25.	14	.5000
160.	16.	43	.3420
170.	8.	20	.1736
180.	0.	00	.0000

Quest. Which is most advantageous in sustaining the floor of a room 24 feet wide; a girder consisting of a single piece of timber 15 *inches in depth, or another composed of 2 pieces of the same length and width, one ten, and the other five inches in depth, laid one upon the other; and what is the relative advantage gained by each?*

The lateral strength of beams being to each other as the breadth

and square of the depth, we have, by assuming the given breadth of the beams $= b$, and the depth of the largest beam $= 15$ inches $= d$; the relative strength of the single girder $= bd^2$; and the relative strength of the compound girder, which is equal to the sum of its parts, equal $b \times (\frac{2}{3} d)^2 + b \times (\frac{1}{3} d)^2$, that is, equal to $\frac{5}{9} bd^2$. Hence, if we put unity for the absolute strength of the single girder, we shall have the absolute strength of the compound girder equal $\frac{5}{9}$: or, in other words, the single beam will be $\frac{1}{3}$ the strongest.

Quest. What is the proper figure of a wall to resist the pressure of earth acting at an angle of 45 degrees?



Let the wall be represented by the line ABC, in the adjoining figure. Put the perpendicular height of the wall BC $= a$. The variable abscissa BE $= x$, and its corresponding ordinate DE $= y$. Now the mean of the pressure on BE or x is at $\frac{1}{2} x$; and the effect of the pressure at this point to overturn or break the wall at C, is as the number of particles (x) and the lever $a - \frac{1}{2} x$. That is, the effect of the pressure at this point will be as $(a - \frac{1}{2} x)\, x$.

The fluxion of the force, therefore, at this point, is $adx - xdx$. Hence the fluxion of the effect of *all* the forces on the line BE, will be $(adx - xdx)\, x = axdx - x^2dx$. Wherefore, by integrating, we shall have $\int axdx - x^2dx = \frac{1}{2} ax^2 - \frac{1}{3} x^3$. Therefore, when $x = a$, we have the whole effect to break the wall at C equal $\frac{1}{6} a^3$. Hence it follows that the effect of the pressure to break the wall is in the triplicate ratio of the height; that is, the effect at C, is to the effect at any other point E, as BC^3 to BE^3. Now the strength of the wall to resist fracture in any point, as at E for instance, being as the square of the thickness DE^2, it follows that the wall, in order to be equally strong throughout its height, must have x^3 always proportional to y^2. As this property is known to exist between the abscissa and ordinates of the semi-cubical parabola, this, therefore, is the proper figure (ADB) required by the question. With regard to the given angle at which the earth is supposed to act, we may observe that this tends only to affect the energy, and not the relation of the pressure throughout the height of the wall.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Observations on the Force of Bodies in Motion, in reply to the remarks of J. P. E. *upon that subject.*

At p. 212 of the last number of the Journal of the Franklin Institute, there is a communication signed J. P. E., intended as a

reply to some remarks in the preceding number, on the power of heavy bodies in motion, the writer of which commences with "*Proposition 1st*, if a double velocity in the same quantity of water gives a double force, then it will raise, when applied to mill wheels, double the weight to double the height, in the same time." If the writer intends, in the foregoing proposition, that when the float-boards of wheels are moving with a double velocity, and they be struck by the same quantity of water with a double force, the effect will be as stated, he is correct; but it does not follow that when the same quantity has struck with a double *force*, that it will have struck the floats with a double *velocity;* or, when it is known that one wheel is struck by the same quantity of water at velocity one, and another wheel be struck by the same quantity at velocity two, in a given time, it does not follow that the same number of particles will expend their force at the same instant on each wheel. Suppose a water wheel to be 10 feet in diameter, and containing 30 float-boards, to be propelled by a quantity of water, whose volume is 1 foot wide, 4 inches deep, and 30 feet long, moving on the wheel at velocity one, and that this will cause the wheel to make one turn in 20 seconds, and suppose some given section of this volume to act on the wheel at the same time, say 1 foot, then the wheel will be urged round by the force of one-thirtieth of the whole quantity of water throughout the whole time of the operation. Then, suppose another wheel 20 feet diameter, with 60 float-boards, to be propelled the same length of time, by the same quantity of water moving with velocity two, it is evident that the volume of water must be 60 feet long, 1 foot wide, and two inches deep, and that no greater length of this volume can act on the wheel at the same time, than in the first case, viz. one foot, which will be one section for each float-board, and a force equal to one-sixtieth part of the whole volume will act through the whole time, the result will not be changed by assuming a greater or less length of the volumes of water to act at the same time on both wheels, nor by using wheels of equal size. I therefore conclude, that when a particle of water strikes the float-board of a wheel with a double velocity, it impresses on it *more* than a double force.

J. P. E. says, that "the following experiment, which is laid down in the books, I consider as direct proof, that the momentum of bodies is as their velocity, and not as the square of their velocity, as the writer above mentioned endeavours to prove. I took two balls of soft clay, one double the weight of the other, and hung them by strings of equal length, to a nail in the wall. I then drew them in opposite directions from *the line of direction*, the smallest to double the distance of the other, and let them fall towards each other; when they met, all motion ceased; proving that the double velocity of the smaller body, which it is known to acquire, in the present circumstances, exactly counterbalanced the double weight of the other body, with half the velocity."

Here he leaves no room to doubt his meaning of the word momentum, as being synonymous with power; and, consequently, that a double velocity of water gives a double power, which leaves him in

the dilemma, of having endeavoured to support that a double power of water will produce a quadruple effect, as he says a double velocity is known to do. Were it not for the above experiment, I should have supposed that he considered the question at issue to regard the simple forces of bodies in motion, without regard to their utmost power; this, however, cannot be the question, for the forces of bodies in motion do not exist, excepting when some resisting force opposes their motion. It is evident that the simple force of a body, whatever be the quantity of matter, or its velocity, when acting on another body, must always be equal to the force with which the latter body resists it, until the body in motion be stopped: for, if 100 lb. of matter, moving with any given velocity, strike one pound at rest, the simple force exerted must be equal to the inertia of the one pound; but if it had struck fifty pounds, the force would have been equal to the inertia of fifty pounds; and if the body at rest be unmoved by the collision, and it, as well as the moving body, were perfectly hard and perfectly non-elastic, then the force impressed would be exactly equal to the power of the moving body; but as we have no materials perfectly hard and non-elastic, the force impressed by collision can never equal the momentum of the moving body; hence the question at issue does not apply exclusively to simple forces.

With respect to friction, J. P. E. says, "I performed a number of experiments in the presence of the gentleman whose opinions are here controverted, which I need not now detail, all showing that the spaces passed over by a body on a horizontal plane, when the body comes to rest, are as the squares of the velocity; that is, with a double velocity, a body will move four times as far, and with a triple velocity, nine times as far, &c. before it comes to rest."

This experiment has further confirmed the theory which he endeavours to controvert; viz. that the powers of bodies in motion are as the squares of their velocities, and that the momentum destroyed by friction, will be equal in equal spaces passed over; thus it appears, although "one experimental truth may be of more value than a thousand ingenious theories," that in this case, as it undoubtedly is in many others, when truths have been established by experiments, different individuals make different deductions from them, to suit their preconceived theories, instead of carefully examining the laws which govern the results; the neglect to do which, may, and frequently does, lead to practical errors; for if J. P. E. should wish to erect machinery requiring a fly wheel of a given weight, to be moved with a given velocity, but, from a change of arrangement, or some other cause, he should find it more convenient to drive the fly with only half the computed velocity, he would double the quantity of matter to compensate for the diminished velocity, whilst his antagonist would quadruple the weight to obtain the same effect. In such a case, although they both suppose themselves acting with knowledge obtained by practical experiment, either one or the other of them must have committed a serious practical error, which a careful "inquiry into causes would have prevented."

If J. P. E. wishes a further investigation of this subject, will it not be best for him first to state particularly such experiments as he may have witnessed, or that are "laid down in the books," which are most relied on by him to establish his theory? JERSEY.

Mode of Preserving Eggs.

The Revue Encyclopedique (vol. 38, 1828) contains the annunciation of a mode of keeping eggs fresh, by placing them in a solution of chloride of lime.

A later number of the same magazine, (vol. 40, October, 1828) gives an extract of a letter from M. Peschier, of Geneva, claiming for his brother, a druggist of that place, the merit of the discovery of a more economical mode of effecting the same object, by placing the eggs in *lime water*. This letter is accompanied by an account of the results of experiments made, in which eggs had been kept sound for six years by this method.

A friend educated in Connecticut, assures me that this method of keeping eggs has long been known and practised in that state.

B.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Notice of an article at p. 214 of the last number of the Journal of the Franklin Institute.

MR. EDITOR,—On looking over the last number of the Journal of the Franklin Institute, I noticed some remarks on a "Reply to the query, does a body descending on an inclined plane with an accelerated motion, press the plane with the same force through every portion of its length?" The conclusion drawn in your remarks, appears to me to be incorrect.

You say that the rapidity of motion acts in the same manner as a centrifugal force in preventing the body from pressing the plane. This cannot be so, for the plain reason, that there can be no effect produced without a cause, no matter what projectile velocity you give the body in the direction of the plane, it cannot, in the least degree, affect that portion of gravity which acts perpendicular to the given force. It must be clearly perceived that that portion of gravity will remain constant, and will, consequently, cause the body to exert a uniform pressure on all parts of the plane, as shown in the diagram given in my previous solution.

The only effect that an increased velocity can have, in the matter in question, is, to cause the body to remain a less portion of time on each particular part of the plane.

E. GRIFFETH.

Philadelphia, September 24th, 1829.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

NOVEMBER, 1829.

Experiments on the Friction and Abrasion of the Surfaces of Solids. *By* George Rennie, Esq. F. R. S.

[From the Transactions of the Royal Society.]

The paper now offered to the consideration of the Royal Society, comprises the results of part of a series of experiments undertaken in the year 1825, with a view to determine the measure of the retardation of bodies in motion, when affected by the attrition of their surfaces, and by mediums of different densities.

From the attention that has hitherto been paid to this important branch of mechanical science, and from the many elaborate dissertations and experiments that have appeared at different periods, it would naturally be concluded, that the subject had been so fully elucidated, as to admit of little, if any further, investigation: but the diversity of opinions still prevalent among philosophers, and the difficulty of reducing to a satisfactory state the doctrines already advanced, incline me to the opinion that the subject is as yet but imperfectly understood. This may be attributed, in a great degree, to the very defective state of our knowledge of the properties of materials, and the difficulty, or rather impossibility, of subjecting them to geometrical mensuration. The science of mechanics considers forces as reduced to the simple questions of mathematical analysis, without regard to the properties of matter, or the phenomena incident thereto: but in rendering forces sensible, we are necessarily compelled to make use of agents, or intermediate bodies, termed machines, the employment of which in transmitting motion,

in modifying its action, or in restoring the equilibrium between forces of different intensities, constitutes the object of every mechanical operation. The solution of this question, therefore, involves the conditions of equilibrium, both of simple and compound machines; the transmission of motion under different circumstances; the construction and combination of the different parts of machines, and the properties of the materials of which these parts are composed.

On a former occasion an attempt was made to develop some of the properties of solid bodies in resisting the action of a disruptive force,* the measure of which was represented by the sum and qualities of the particles displaced. The connexion may be traced, in the present inquiry, which relates principally to the resistance arising from the displacement, or rupture, of the superficial asperities of bodies in motion when brought into contact by extreme pressure, and is analogous to the cohesive state of a body acted upon by opposite, but contrary forces. But the cases investigated by experimentalists have seldom been carried to the extent necessary to produce a disrupture of the prominencies, being generally confined to the definition of friction as designated by writers on mechanics, to be the force expended in raising continually the surface of pressure by an oblique action; the surfaces being represented by a series of inclined planes acting against each other in alternate succession. The measure of friction, therefore, being supposed to depend upon the angles of the prominencies and the elementary structure of the bodies, the effect of polishing could only be to diminish those prominencies without altering their curvature or inflections. The expense of force, therefore, ought still to remain the same in both cases.† In this hypothesis it is reasonable to concur, experiment proving, that the amount of friction bears immediate reference to the elementary structure of bodies; and although the doctrine of inclined planes admits of a ready comprehension of the causes of this kind of resistance under certain circumstances, a very slight investigation of the nature of the bodies themselves will exhibit their asperities under every possible configuration. The amount of resistance will depend upon the degree of pressure, the approximation, or rather the engagement of the asperities and concavities, and the nature of the surfaces of which fibrous, soft, or hard bodies, are composed. To surmount, bend, or detach these asperities, under the circumstances of pressure, area, and velocity, demands a proportionable exertion of force; and it is by the determination of this force under all cases, that we can alone arrive at an estimation of the performance of machines.

The nature of friction has excited the attention of most of the writers on mechanics, from the period of the first two dissertations of Amontons, in the year 1699, down to the more elaborate researches of Coulomb and Vince, in 1779 and 1784. Amontons was the first that attempted to develop and reduce theory to calculation. He

* Experiments on the Strength of Materials:—Philosophical Transactions, 1817.

† Leslie's Experimental Philosophy.

affirmed that friction was not augmented by an increase of surface, but only by an increase of pressure;* and in a subsequent paper, illustrated by some experiments on wood and metals pressed by springs of known intensity, he drew similar conclusions, with the addition that friction was one-third of the pressure, and that the amount was the same both with wood and metals when unguents were interposed. He likewise concluded, that friction increased or diminished with the velocity, and varied in the ratio of the weight and pressure of the rubbing parts, and the times and velocities of their motions. These hypotheses were adopted more or less by most of the philosophers after Amontons, but particularly by De la Hire,† who satisfied himself by several experiments, of the truth of Amontons' conclusions; but they were questioned by Lambert, although without the test of experiment. Parent suggested an investigation of the subject in his proposition of the spheres, and by determining the angle of equilibrium, at which a body resting on an inclined plane commenced sliding. And the celebrated Euler, in a very elaborate paper,‡ conceived it to depend upon the greater or less approximation of the asperities of the surfaces brought into contact by pressure, the resistance to which he allows to be one-third of the pressure; the same as Amontons. Of the effect of velocities, he was, however, uncertain; but observed that when a body begins to descend an inclined plane, the friction of the body will be to its weight or pressure upon the plane, as the sine of the plane's elevation to its cosine, &c. But when the body is in motion, the friction is diminished one-half. Muschenbroek and others maintained that friction increased with the surface; and Bossut distinguished it into two kinds: the first being generated by the gliding, and the second by the rolling of the surface of a body over another: and remarked, that it was effected by time, but that it neither followed the ratio of the pressure nor the mass. Brisson§ attempted to construct a table of coefficients, to denote the value of the friction of different substances; but they are inapplicable to practical purposes, for want of proper experiments. Desaguliers considered the nature of friction with a good deal of attention, but principally with reference to the rigidity of cords. He, however, quotes the experiments of Camus as best calculated to illustrate the subject; nevertheless, they were made on too small a scale to derive any satisfactory conclusions. Schober and Meister coincided with Muschenbroek in the opinion, that the spaces were as the squares of the times in the case of a body uniformly accelerated. The opinions of many other eminent philosophers, such as Leibnitz, Varignon, Leupold, Bulfinger, Daniel Bernoulli, Ferguson, Rondelet, Gregory, Leslie, Young, Olivier,|| &c. might be quoted. But it is to Coulomb principally that we are indebted for the knowledge we possess of this kind of resistance.

* Sur la Force des Hommes et des Chevaux, et de la Resistance causé dans les Machines.

† Mémoires de l'Academie des Sciences. ‡ Ibid.

§ Brisson, Traité de Physique.

|| Sur les diverses Espèces de Frottements, &c. (not published.)

In the year 1779 the Academy of Sciences at Paris, being desirous of rendering the laws of friction, and the effects resulting from the rigidity of cords, applicable to machines,—Coulomb undertook, in the arsenal at Rochfort, a very extensive series of experiments, which he afterwards published in 1781 under the title of "Théorié des Machines simples, en ayant égard au Frottement de leurs Parties, et á la Roideur des Cordages."* The memoir is divided into two parts. The first treats of the friction of surfaces gliding over each other, and the second enters into an examination of the rigidity of cords, and the friction of the rotary movements of axles. Coulomb commences his work by examining the friction of plane surfaces gliding over each other, distinguishing it into two kinds; the first resulting from time, and the second from velocity. The first may depend on four different causes, viz.

1st. The nature of the bodies in contact.

2nd. The extent of surface.

3d. The pressure on the surface.

4th. The time the surfaces have been in contact. And he even adds a

5th. The state of the atmosphere; which he, however, thinks may have little influence.

The case of bodies gliding over each other with a certain velocity, he considered to be referrible to the first three causes, besides the velocity of the planes in contact.

With regard to the physical cause of friction, he coincides with the opinions of Amontons and others, that it arises from the entangling of the asperities, which can only be disengaged by bending or breaking. These experiments led to some important results, viz.

1st. That the friction of wood on wood without unguents, was in proportion to the pressure which attained its maximum in a few minutes after repose.

2nd. That the effects of velocities were similar; but the intensities were much less to keep the body in motion, than to detach it from a state of rest, oftentimes in the ratio of 22 : 95.

3d. That in the case of the metals the results were likewise similar; but the intensity was the same, whether to disturb or maintain the motion of the body.

4th. That with heterogeneous surfaces, such as those of woods and metals gliding over each, the intensity did not attain its limit sometimes for days.

In general, however, with woods and metals without unguents, velocities were found to have very little influence in augmenting friction, except under peculiar circumstances.

The treatise of Coulomb is illustrated by a great variety of interesting experiments, and forms the most valuable work we possess on the subject.

In the year 1784, Dr. Vince endeavoured by some very ingenious experiments, to determine the law of retardation, together with the

* Memoires des Savans Etrangers, tome 163 and 333.

quantity, and the effect of surface on friction. The results were, that the friction of hard bodies in motion was a uniformly retarding force, but not so with cloth and woollen, which were found in all cases to produce an increase of retardation with an increase of velocity.

That the quantity of friction amounted to about one-fourth of the pressure, and that it increased in a less ratio than the quantity of matter or weight of the body.

That when the surfaces varied from 1.61 : 1 to 10.06 : 1, the smallest surface gave the least friction: and, finally, that friction was greatly influenced by cohesion.

Dr. Vince's conclusions regarding the laws of retardation were partly confirmed by the late ingenious Mr. Southern, of Soho, who, in a letter to Dr. Vince in 1801, communicated the results of several experiments on the surfaces of the spindles of grindstones moving with great velocities; when it was found that with the rubbing surfaces moving at the rate of 4 feet per second over a length of surface of 1000 feet, the resistance arising from the friction of 3700 lbs. of matter, only amounted to one-fortieth of the weight.

In the year 1786, and subsequently, the late Mr. Rennie made several experiments on the friction and resistance of heavy machinery. The results varied under different circumstances; but it appeared that an augmentation of resistance took place in proportion to the quantity of machinery put into action. In one instance, in the ratio of 1 to 5, when it absorbed from one-fifth to one-tenth of the power expended.

This anomaly, as compared with the ratio of surfaces in the present experiments, can only be accounted for, from the irregularity of the movements and the difficulty of producing simultaneous actions in complicated machinery; the more especially as the results were affected by contingencies which could not be properly estimated; some of the elements on which the deduction is founded not being stated. The resistance was, likewise, increased, by reversing the direction of motion. The velocities being very moderate, and hardly exceeding 120 feet a minute, appeared to have had no influence: but the experiments related principally to the resistances produced by different kinds of machinery. The experiments of M. Boistard* on the gliding of stones, with a view to develop the equilibrium of arches, led him to conclude that the relation of the friction to the pressure was constant; that asperity of surface did not alter its value, which generally amounted to four-fifths of the pressure.

From similar experiments M. Rondelet concluded,†

1st. That the rougher the surface of stones, the greater the power required to move them.

2nd. That the greater the insistent weight, the greater the resistance: but as the inequalities are apt to be broken, the maximum

* Recueil d'Experiences et d'Observations, &c. sur le Pont de Nemours.
† L'Art de Batir, tome iii. 1808.

force required to overcome the friction, ought to be equal to produce that effect, whatever be the weight of the stone.

3d. That this force ought rather to be in the ratio of the hardness of the stone than of its weight.

4th. The amount of friction varied from one-half to one-third of the insistent weight.

5th. The angle of equilibrium of similar stones was about 30 degrees. And,

6th. Finally, extent of surface did not alter its value.

The experiments of Morisot on the grinding and polishing of stones, and of Maniel and Pasley on the pressure and equilibrium of earths, present some interesting results; but it is only recently that our knowledge of the subject has been materially enlarged.

The agitation of the canal and rail-road question in the years 1824 and 1825, and the invention, or rather revival, of a mode of applying steam in lieu of animals to carriages on rail-roads, led to the most extravagant conclusions: and although the doctrines of Coulomb and Vince, relative to the equality of resistances under different velocities, have been still further confirmed by the experiments of many able persons in this country, such as Chapman, Grimshaw, Wood, Tredgold, Palmer, Roberts, and others, and much valuable information elicited;—our progress in the science has been but slow and unsatisfactory. Sensible of these defects, and being unable to profit by the valuable treatises subsequently published, it occurred to me that a series of experiments founded on the omissions of former writers would be extremely desirable.

The present series of experiments relates to the friction of attrition. This branch of the science comprehends the resistance occasioned by solid bodies,—such as ice, cloth, paper, leather, wood, stones, metals, &c. gliding over each other simply, or by the intervention of semi-fluids or unguents, such as oil, tallow, &c.

The object has, likewise, been to determine the powers to resist abrasion under the circumstances of surface, pressure, and velocity. Examples have been sought,

1st. From ice, by the resistance of its surface to sledges, skates, &c.

2nd. From cloth, by its remarkable properties of resistance in opposition to the law observed by solids.

3d. From leather, by its great utility in the pistons of pumps, &c.

4th. From wood, in its application to pile driving, carpentry, launching of ships, &c.

5th. From stones, as relating to the equilibrium of arches and buildings. And,

6th. From metals, from their universal application to machinery; but more particularly to wheel carriages and rail and other roads, on which a great many experiments have been made.

Experiments on a great scale, however, frequently involve so many contradictions, from the difficulty of obtaining the necessary elements, that I have deemed it preferable to offer the present series,

as comprehending in a greater degree most of the cases in question, and affording a more systematic view of the nature of the investigation.

[TO BE CONTINUED.]

On the Manufacture of French Articles of Perfumery.

[From the *Dictionnaire Technologique*, translated for the Technological Repository.]

The art of the perfumer is derived, according to some historians, from the most remote periods. Diodorus of Sicily pretends, that the Egyptian priests were the only possessors of the necessary recipes for embalming dead bodies.

The number of these articles of perfumery is now-a-days become very considerable.

The business of the perfumer consists in the preparation of the various products which we shall hereafter mention, and which are divided into two classes: namely, the perfumes from Grasse, and those of Paris. The first and most important branch comprehends the fabrication of the prime materials, and which should be done in the localities where they are produced; and the second also merits attention, from the immense consumption of articles in perfumery.

THE PERFUMES FROM GRASSE, IN THE DEPARTMENT OF VAR.

Preparation of the fats of the pommades by infusion, and of those made without infusion; on oils; on distillation; and on the extraction of essential oils or essences.—Grasse, from the mildness of its climate, is one of the finest towns in Provence, the natural soil of the aromatic plants. Numerous and various kinds of flowers grow in such abundance there, as to require but little care in their culture. Amongst those ordinarily grown at Grasse, we may enumerate the following: the jasmine, the rose, the violet, the tube-rose, and the jonquille. It is to be regretted that, amongst the number, we cannot also find the orange, the citron, the hyacinth, the mignonette, the heliotrope, which would double the revenues of the proprietors; but we suppose that there exist causes which oppose their vegetation. Not two leagues from thence, in the small village of Canet, they collect various kinds of flowers, of which the annual product cannot be less, on a moderate estimation, than two hundred thousand francs!

Before describing the processes employed in the fabrication of the perfumeries of Grasse, we must give an idea of the mode of preparing the fatty materials. These take the precedence before all others; as from them are prepared a great part of the perfumeries of Grasse, as well as those of Paris.

The perfumer employs in the whole three kinds of fat: namely, that of pork, beef, and mutton. The modes of preparing them differ but little from those in common use; but it is necessary, nevertheless, to make known the changes and improvements which the perfumers have latterly made in their manipulations; and which relate only to the fats of pork and mutton. The first is pounded and beaten

in an iron mortar, after having previously cut it small with a hatchet or cleaver; and the second must be carefully freed from all the fleshy parts before subjecting it to the action of heat.

When thus prepared, the fats are pure, and of a perfect whiteness; but care must be taken that the time employed in preparing them be not too much prolonged, lest they might begin to putrify. This quick alteration may also be owing to their retaining some portion of water (an inconvenience difficult to avoid, as in evaporating them sufficiently to drive off the last portions of water, they risk the decomposition of part of the fatty matter also.) The perfumers have, for several years past, adopted the following process, which appears preferable. They pound the fats without the addition of any water, until all the membranaceous parts are completely separated; they then throw this prepared mass into a boiler, heated by a *balneum-marie*, or water-bath. The fat being perfectly melted, the albumen in the blood coagulates, and entangles all the other foreign or extraneous matters; the scum which forms must be carefully removed, and the whole remainder be afterwards passed through a canvass strainer.

ON THE POMMADES MADE BY INFUSION.

Rose, orange-flowers, and cassia.—They take 334 pounds of prepared hog's lard, and 166 of beef suet. (The third part of beef suet which is here added, is intended to give more consistence to the pommade, and especially when it is to be exported to warm climates.) These 500 pounds of prepared fat are to be put into a vessel, termed a *bugadier;* they then add 150 pounds of rose leaves, which they throw upon the melted fat, and carefully stir them for several hours. This infusion, thus prepared, must remain at rest for twenty-four hours; at the end of this time, the pommade is again melted, and continually stirred, in order that none of the rose leaves may adhere to the bottom of the vessel; when melted, it is strained through canvass, in which operation the *marc*, or dregs, take the form of rectangular loaves; these loaves are placed under a press, in order to extract all the remains of the fat from the solid parts. The loaves are held in a barrel, pierced full of holes, and bound with iron, so that the pommade may escape on all sides, and fall into a copper vessel placed under the gutter or spout to receive it.

This operation is repeated many times, in order to avoid the loss which results from the small quantity of pommade which the canvass ordinarily retains. This work, simple as it appears, nevertheless demands great care; and the workman who executes it, can only acquire by practice a perfect knowledge of it.

This process is repeated, with the same fat, ten or twelve times; and thus they employ 3000 pounds of rose leaves to make a good pommade.

The orange-flower pommade is made in the same manner, but it requires still greater care to be taken in pressing it, in order to make it clear, as it is liable to form a deposit.

In preparing the orange-flowers, they remove the yellow parts of

them, when they intend to produce a white pommade; but, unfortunately, their high price prevents them from often practising this method. The pommade, thus prepared, costs at least thirty francs the pound; but it is incomparable as a perfume.

We shall not enter into the details relative to the preparation of the *pommade of Cassia*, as it is made in the same manner as the two preceding ones.

ON THE POMMADES MADE WITHOUT INFUSION.

Jasmine, tube-rose, jonquille, narcissus, and violet.—We take a double dish, termed a *tiame*, and pour into it twelve ounces of the prepared fats of pork and beef, the flowers being contained in the other part; next day these are removed, and replaced by fresh flowers; this process is continued for two or three months, or until the pommade has attained the degree of perfume designed to be given to it. This work requires great care and patience, as the jasmine flowers contain other matters prejudicial to the required scent, which require them to be removed every day; and without taking this precaution, the pommade would become defective.

Some perfumers, nevertheless, employ fusion for making this kind of pommade; but we think it ought to be discontinued entirely, as it cannot but injure this delicate pommade. Lately, M. Thias, of Grasse, has contrived to substitute for the *tiames*, frames composed of four pieces of wood perfectly united, into which he puts a glass vessel, containing the pommade, spread over it with a palette-knife. This is an advantageous improvement, as the room which the *tiames* occupied was considerable, and their great weight was also an obstacle to their superposition. Now these frames can replace them, and the perfumers require four thousand of them for their establishments. The frames are placed one above the other, and a cover is placed over the uppermost one, to hinder the access of the external air. This work is sufficiently curious to attract the attention of travellers, who find a pleasure in visiting the laboratories of the principal manufacturing houses of Grasse.

ON PERFUMED OILS.

The oils of roses, orange-flowers, and cassia.—These are made by infusion, like the pommades of the same odours; and it is an indispensable precaution, that we choose oils which are perfectly fresh; for those of *jasmine, tube-rose, jonquille, and violet*, and, in general, of all delicate flowers, the following is the process:—

They place, on an iron frame, a cotton cloth, imbibed with olive oil of the first quality, and which they completely cover with the flowers. This layer must be but of little thickness. They continue this process, changing the flowers until the oil is saturated with the odour which they desire to communicate to it; at the end of this time, which we can easily conceive must be variable, they submit the cloths to the action of a press. This last part of the process usually occupies eight entire days.

ON DISTILLATION.

The essential oils or essences obtained in the south of France, are those of *roses, neroli, petit-grain, lavender, wild-thyme, thyme, and rosemary.*

These essences are distilled in the usual manner. They obtain, by putting into the body of the still forty pounds of rose leaves, and thirty pints (French) of water, and proceeding to distillation, fifteen pints of rose water. They then continue the operation until they have thus obtained 200 pints of water, termed No. 1. In this first distillation, they obtain an almost imperceptible quantity of the *essence of roses;* but in the second it becomes more apparent; and, finally, in the fifth it becomes notable.

The house of Langier, senior and junior, annually make 250 ounces of essence of roses.

In the distillation of *orange-flowers*, they also obtain the *essence of neroli*, now become of remarkable importance. If they would obtain this essence, they follow the ordinary process, and repass the waters of the first distillations upon new flowers. On the contrary, when it is intended to prepare orange-flower water of a good quality, they draw off a fifth part only of the water placed in the cucurbit.

The essence de petit-grain is obtained by distilling the leaves of the orange-tree; the quantity of essence they afford depends upon their freshness. With respect to those of lavender, wild-thyme, thyme, and rosemary, they present no peculiarities in their extraction.

ON SPIRITUOUS ESSENCES.

Rose, orange, jasmine, tube-rose, cassia, violet, and other flowers.—They take three water-baths, furnished with covers, and put into one of them twenty-five pounds of one of the perfumed oils abovementioned, and twenty-five litres of spirit, marking three-sixths; they stir the whole every three-quarters of an hour during three days; at the end of this time they decant the spirit thus perfumed, and pour it anew into the second water-bath; they again repeat the same operation in the third bath, and the spirit then obtained is perfected. By continuing the process with the same oil, they likewise obtain inferior qualities, and which they indicate under the terms, No. 2, 3, and 4.

Some perfumers pretend that they dispense advantageously with these oils, by employing pommades strongly impregnated with odours; we cannot say to which of the two the preference ought to be given, as they obtain by both processes similar results.

Scented Spirits.

7 *litres** spirit of jasmine, third operation.
7 *litres* spirit of cassia, third do.
3 *litres* spirit of three-sixths.
2 *litres* spirit of tube-rose, third operation.
1½ ounces of essence of cloves.

* The *litre* is nearly two and one-eighth English wine pints.

½ an ounce of fine neroli.
1½ ounce of essence of bergamotte.
8 ounces of musk, second infusion.
3 *litres* of rose water.

Italian spirit of flowers.

2 *litres* spirit of jasmine, second operation.
2 *litres* spirit of roses, second operation.
2 *litres* spirit of oranges, third operation.
2 *litres* spirit of cassia, second operation.
1½ *litres* of orange-flower water.

Spirit of Cytherea.

1 *litre* of spirit of violets.*
1 *litre* of spirit of jasmine, second operation.
1 *litre* of spirit of tube-rose, second operation.
1 *litre* of spirit of pinks.
1 *litre* of spirit of roses, second operation.
1 *litre* of spirit of Portugal.
2 *litres* of orange-flower water.

PERFUMERIES OF PARIS.

Of Pommades.—We can reckon twenty odours for pommades; from flowers and from compounds. This last kind of pommades is an imitation of those flowers which are not cultivated in France. The essences usually employed in making of pommades are those of *bergamotte*, citron, *cedrat*, *limette*, Portugal, rosemary, thyme, wild-thyme, lavender, marjorum, and cinnamon.

We divide these pommades into three qualities:—

Fine pommade.
Superfine pommade.
Roman pommade.

As these last require particular care, we shall give the preparation of the Roman *pommade à la Vanille.*

12 pounds pommade of roses.
12 pounds oil of roses.
1 pound *Vanille*, first quality, pulverized.
6 ounces of *bergamotte*.

The pommade must be melted in a water-bath; the vanille is then to be thrown in, and stirred continually for an hour; it is then left at rest for two hours; this time is sufficient for the vanille to be completely deposited; the clear part is then to be drawn off, and the pommade thus formed will be of a yellow colour, which is much preferable to that of the ordinary brown colour.

We must here make an observation relative to the odorous extracts and waters. We should always employ in preference the spirits of flowers; which ought to be prepared by first macerating the flowers in the alcohol, and then adding the different essences.

* These spirits usually mark 28° of the *alcometre.*

necessary to give the perfume the required odour. Unfortunately, they often neglect to perform this necessary operation. These spirits of flowers ought always to form the bases of good perfumes.

ODOROUS EXTRACTS.

The alcohometric degree of the spirit employed for these, however variable, should always exceed 28 degrees.

Extrait de Bouquet.

2 *litres* spirit of jasmine, first operation.
2 *litres* extract of violets.
1 *litre* spirit of cassia, first operation.
1 *litre* spirit of roses, first operation.
1 *litre* spirit of oranges, first operation.
1 *litre* extract of pinks.
4 *gros* of benzoin.
8 ounces of essence of amber, first infusion.

Extract of Peach Blossoms.

6 *litres* of spirit, at three-sixths.
6 pounds bitter almonds.
2 *litres* spirit of orange-flowers, second operation.
4 *gros essence de laurier amande.*
4 *gros* balsam of Peru.
4 ounces essence of citron.

COLOGNE WATER.

There are two processes which are equally employed in the preparation of *cologne water;* namely, distillation and infusion.

The first is now generally abandoned; but it is, nevertheless, beyond contradiction, the preferable one.

The only essences which are employed, and which have given to this water its great celebrity, are the following: *bergamotte,* citron, lavender, rosemary, Portugal, and *neroli.* All these should be of the first quality; but their proportions may be varied according to the choice of the consumers.

The lavender waters are now indeed but little esteemed; nevertheless, for their virtues, they are in daily use; they ought always to be prepared from the fresh flowers, and not by a solution of the essence of lavender in alcohol.

ODOROUS WATERS OF LAVENDER, HONEY, VULNERARY, AND ARQUEBUSADE.

We can reckon, in articles of perfumery, thirty different odours; these are varied according to the choice and skill of the manufacturer. We shall content ourselves with giving the recipes for the three following ones. Amongst these will be found the *English honey-water,* which we now manufacture with great success.

Honey-water.

6 *litres* of spirit of roses, third operation.
3 *litres* of spirit of jasmine.
3 *litres* of natural spirit, of three-sixths.
3 ounces of essence of Portugal.
4 *gros* flowers of benzoin.
12 ounces essence of vanille, third infusion.
12 ounces essence of musk, third infusion.
3 *litres* of orange-flower water, of a good quality.

Eau de Mille Fleurs.

18 *litres* of spirit of three-sixths.
4 ounces of balsam of Peru.
8 ounces of essence of *bergamotte.*
4 ounces of essence of cloves.
1 ounce of essence of ordinary neroli.
1 ounce of essence of thyme.
8 ounces of essence of musk, third infusion.
4½ *litres* orange-flower water.

Eau de Mousseline.

2 *litres* spirit of roses, third operation.
2 *litres* spirit of jasmine, fourth operation.
1 *litre* spirit of pinks.
2 *litres* spirit of orange-flowers, fourth operation.
2 ounces essence of vanille, third infusion.
2 ounces essence of musk, third infusion.
4 *gros* essence of sandal-wood.
1 *litre* orange-flower water.

All these three waters should mark twenty-four degrees. As they possess similar properties, they require no further remark.

Lately, MM. Langier have invented two new waters; one of these is named *eau de Langier*, and the other *eau anti-pestilentielle.* This last is principally intended to remove the disagreeable odours which are produced whenever the chlorates are made use of.

Dentifrice Waters.

We shall indicate those of these waters which are most known.

Eaux de Grenouch, balsamique, dentifrice et rose ètherée.—Some persons prefer to use powders; but they are always hurtful, on account of the cream of tartar which they contain.

Etherial Balsamic Water.

3 *litres* of spirit of three-sixths.
2 *gros* of spirit of mint.
2 *gros* spirit of neroli, best quality.
2 *gros* spirit of cinnamon.
2 *gros* spirit of amber.
1 *gros* of sulphuric ether.

Put them into a matras, and infuse them in a water-bath for eight days.

Balsamic Water.

18 *litres* of spirit of three-sixths.
1½ *litres* of spirit of cochlearia.
1½ *litres* of spirit vulnerary.
9 pounds of cloves.
12 pounds of the roots of *pirette.*
12 pounds of fine cinnamon.
3 pounds of starry anise-seeds.
2 *gros* of saffron.
4 *gros* of fine spirit of mint.

ESSENCES FOR REMOVING SPOTS.

There are two essences equally employed for this purpose; the one is termed *essence de citron*, and the other *essence nouvelle à détacher;* both of the two have the advantage of not leaving any unpleasant odour.

Essence à Détacher, Parfumée.

3 *litres* of spirit of three-sixths.
1 pound of white soap.
1 pound of ox-gall.
1 ounce of essence of citron.
2 ounces of essence of mint.

ALMOND PASTE.

These are divided into three kinds, but are all prepared nearly in a similar way; namely, brown almond paste, white sweet almond paste, and white bitter almond paste.

The first is made of the kernels taken out of apricot stones, as also with almonds; these are formed into loaves, weighing five or six pounds each, and are then subjected to pressure, in order to extract the oil (300 pounds of almonds will yield about 130 of oil.) The press is turned or squeezed closer every two hours, during three days; at the end of this time the loaves are withdrawn from the press, when they are dried, in order to be pounded; and, lastly, are passed through a sieve.

The second kind is obtained by scalding the sweet almonds in boiling water, until their skins become completely detached; they are then put into a basket and cooled, and the skins entirely separated; when they are become dry, they are subjected to the same processes as the preceding.

The third kind is prepared as the second is, only that bitter almonds are made use of.

[TO BE CONTINUED.]

On the Preparation of German Silver, Packfond, Argenton, or Electrum: a new Metallic Alloy.

[From the *Dictionnaire Technologique*, translated for the Technological Repository.]

This is a new alloy, known by these different names; and is composed of copper, nickel and zinc; and which imitates silver sufficiently well, owing to its whiteness, its hardness, and its unalterability.

To manufacture this alloy, which now begins to be much used in Germany, it is necessary to commence, by purifying the *speiss*, or *kupfernickel;* an ore which contains, besides nickel, a little cobalt, copper, iron, and much arsenic; and from which it is essential to free it. The Germans have not made known by what means they refine it; but it is probable, that by the aid of roasting, and repeated fusions, they free it from the arsenic. This, however, is certain, that we receive what is termed the *pure nickel*, from Germany, in two different states; namely, in small grains, well fused, and in the form of a coarse black sponge, which has no metallic lustre: they state that neither of these contain any arsenic; nevertheless, they do contain a small portion of it; and in order to employ this alloy with advantage, it would be useful to search for a more exact method of purifying it.

The following are the processes employed in Germany to make *packfond*, as described by MM. Robert and Co. This alloy is formed in various proportions; and it is harder, and less liable to alteration, the more nickel it contains. Thus, for example, we may employ one part of nickel, two and three-quarters parts of copper, and three-quarters of a part of zinc. This last alloy is more difficult to work, on account of its hardness; but as it is less liable to alteration, so we should give it the preference for various utensils for culinary purposes, as well as for the laboratory.

We must also observe, that the *packfond* is the better, accordingly as the zinc and copper, which enter into its composition, are the more pure; and they affirm, that the presence of a little lead in the zinc, greatly diminishes the malleability of the alloy.

Supposing, then, that we are furnished with all the materials properly prepared, and have at command a wind-furnace with good bellows; we commence with pulverizing the spongy nickel, to which we add the necessary proportion of zinc, and place the mixture in a crucible, covering it with the requisite quantity of copper. When the crucible has been thus charged, and well covered, it must be placed in the furnace, upon a foot of baked clay, resting upon the grate of the furnace; the whole must be covered with charcoal, and exposed to the action of the fire. As the spongy nickel also contains some vitreous portions, and we must remove the scorias which float upon the surface; so, when the whole has entered into complete fusion, we must stir the alloy well with an iron rod, and which will also conduce to render the composition uniform in all its parts; we must then pour it into iron moulds, well polished inside, and which

will form it into ingots, of about an inch thick. In order that these ingots may be conveniently laminated, we may make them about nine lines thick, nine inches long, and four wide.

However well the process may have been performed, yet we shall find at the summit of the ingot, a depression, occasioned by the contraction of the metal in cooling. Its fracture ought to exhibit a fine and close grain, without any air-holes; otherwise, we should find it, in working, to be a metal full of flaws and cracks.

We shall now give, after M. L. Bauhardt, a process for preparing *packfond*, which differs a little from the above. This consists in taking thirty-two parts of copper, and eleven parts of nickel, in grains; these are to be put into a covered crucible, and heated until complete fusion takes place; they must then be well stirred with an iron rod, to render the mixture homogeneous; and when the whole is in complete liquefaction, it must be poured into water, and granulated; it is then to be well dried, and again placed in the crucible; and when heated to redness, eight parts of zinc are to be added; the whole is then to be covered with a proper defensive flux, and the fire must be urged by a strong blast; and when the whole is well fused, the scorias must be removed, and the alloy be poured into an ingot mould. The alloy thus obtained, possesses, according to M. Bauhardt, a great degree of malleability, and is capable of being drawn into fine wire; and it presents the same appearance upon the touchstone, as silver of fourteen carats.

In order to polish the various articles made of *packfond*, we commence with rubbing them with pumice-stone, next with charcoal, and then burnish them with a hard polished steel burnisher; using at the same time soap and water, or beer. When the burnisher becomes dull, it must be brightened, by rubbing it upon a piece of buff leather, impregnated with putty (oxide of tin and lead.)

When there are cavities in the work, into which the pumice-stone cannot be made to penetrate, they may be whitened, by means of a solution of silver, or of tin, diluted with water.

The soldering of the *packfond* requires a great degree of attention in applying the heat, which must be done very gradually, if we would prevent cracks or flaws in it. It is generally soldered with an alloy of the *packfond* with tin; or still better with fine silver.

In order to clean articles made of *packfond*, we may either use finely sifted wood-ashes, tripoli, or ivory-black, well washed and sifted. R.

Remarks by Thomas Gill, Esq.—The nickel is chiefly obtained in this country from the Staffordshire potteries, being procured in the extraction of the cobalt blue from its ores. In Parkes's "*Chemical Catechism*," he says, "it is generally said, that nickel has never been brought into use in England; but I have just heard from Birmingham (in 1803) that some of the manufacturers combine it with *iron*, and thus use it with great advantage; and that others melt it with *brass*, in such proportions, as forms a very handsome compound metal, exceedingly useful for many purposes. The Chinese

use nickel, in conjunction with copper and zinc, for making various articles.

"According to Proust, nickel used in certain proportions, gives a degree of *whiteness* to iron, diminishes its disposition to rust, and adds to its ductility.

"M. Richter has lately (1803) been occupied in a series of experiments upon nickel. He has found that this metal in its pure state is very malleable, nearly as brilliant as silver, and more attractable by the load-stone than iron. It is generally combined with copper; but he has found a method of freeing it from that metal. He says, that when pure, it is not liable to be altered by the atmosphere; that it is perfectly ductile, and has great tenacity. Its specific gravity, when forged, is 8,666. *Annales de Chimie, tom.* III. page 173.

"The most abundant ore of this metal is a sulphuret of nickel, called *kukfernickel*, which is generally a compound of nickel, arsenic, and sulphuret of iron.

"The valuable qualities which M. Richter has discovered in nickel, show that it might be applied to many important uses; particularly for surgeon's instruments, compass needles, and other such articles, as it is not liable to oxidize by the atmosphere. Should an easy mode of working it ever be discovered, we may possibly find this to be calculated for a greater variety of purposes than any other metal.

"It is a curious circumstance, that all the specimens of the stones which have been said to fall from the atmosphere, *contain iron alloyed with nickel*. These stones, which have at different periods been seen to fall on every quarter of the earth, are supposed by many to be cast from a volcano in the moon. Very lately a shower of them fell in Norway, which covered an extent of three-quarters of a league long, and half a league broad.

"Nickel is employed by the Chinese in making their *packfond*, or *white copper*, which is a beautiful metallic compound; but it has not been much used in Europe, although it may be had in considerable quantities."

We see now, however, that it is brought into considerable use in Europe; the Germans having employed it in many ways, and particularly in making the new musical instruments, formerly described by us, and for which it is admirably adapted; as the delicate tongues in them, are easily acted upon by the moisture of the breath, when they are made of steel, brass, or other oxidable metals.

On Making Saltpetre in France, and in Spain. *By* Don Guillermo Bowles.

Mr. Bowles states, that he has evident proofs that the basis of nitre really exists in the earth, and in plants, in different provinces of Spain, the same as in the *soda* of Alicant; and that any one may convince themselves of this truth, and see saltpetre with its alkaline basis, in the manufactures of Castile, Arragon, Navarre, Valencia, Murcia, and Andalusia, where it is made without the assistance of

vegetable matter; only sometimes throwing in a handful of ashes of mat-weed, merely to filtre the lie of earth; and they make excellent saltpetre by boiling the lixivium of their lands only; consequently, they have gunpowder in Spain, without being indebted for its fixed alkali, to the vegetable kingdom, there being a perfect fixed alkali in the earth.

Let us now see how saltpetre is generally made in France, and in Spain; I say nothing of England or Holland, because they make none, importing what they want from the East Indies, where it is found naturally in the earth, as in Spain, where I have seen saltpetre made with the lixivium of nitrous earth, collected in places, where perhaps there never was a tree nor a plant.

Every thing is carried on at Paris, as well as in other parts of France, according to royal ordinances, in the manner I am going to relate:---the rubbish and filth of old houses is carried to the works, and pounded with hammers; the dust is then put into casks, perforated at bottom, the aperture covered with straw, to give a free passage to the liquor. Water is then poured on this dust, which, in its passage, carries away all the saline matter. This impregnated matter is called lie, which, if they were at that period to boil, would produce saltpetre of a greasy nature; to remedy this, they purchase the ashes of all the wood fires in Paris; from which they also draw a lie that is mixed with the former, and they then boil up the whole.* In proportion as the water evaporates, the common salt, which crystallizes when hot, soon falls to the bottom of the caldron; and the saltpetre, which only crystallizes when cool, remains dissolved in the water. They draw off this water, loaded with saltpetre, into other vessels, and place it in the shade, where the nitre crystallizes. This is called saltpetre of the first boiling, having still some remains of common salt, earth, and greasy matter incorporated with it; it is conveyed to the arsenal to be properly refined, being boiled over again, and left to crystallize two or three times, or more, if found necessary; by which means it is cleared of all its impurities, and becomes perfectly adapted to the making of gunpowder, and the other uses to which it is applied in the arts.

In Spain, where a third part of all the lands, and the very dust on the roads in the eastern and southern parts of the kingdom, contain natural saltpetre, I have seen them prepare it in the following manner:---

They plough the ground two or three times in winter and spring, near the villages. In August, they pile it up in heaps of twenty and thirty feet high; they fill with this earth a range of vessels, of a conical shape, perforated at the bottom, observing to cover the bottom with mat-weed and a few ashes, two or three fingers deep, that the water may just filtre through. They then pour on the water (sometimes without putting in any ashes;) the lie that results from this

* The fact seems to be this:—the salt they obtain from the lie of the rubbish, is a nitre with an earthy basis; the fixed vegetable alkali procured from the wood ashes is then added; this alkali precipitates the earth from the nitrous acid, and taking its place, forms true saltpetre.

operation is put into a boiler. The common salt, which, as we said before, precipitates and crystallizes when warm, falls to the bottom, in the proportion of forty per cent.; the liquor is then poured into buckets placed in the shade, where it shoots, and crystallizes into saltpetre. The same earth, deprived of its nitrous quality by this process, is again carried back to the fields, and exposed to the elements; by which means, in the course of a twelvemonth, assisted by the all-powerful and invisible hand of nature, it again becomes impregnated with a fresh supply of nitre; and what is still more surprising, and cannot be observed, without admiring the wonderful works of the omnipotent Creator, the same lands have produced for time immemorial, an equal quantity of saltpetre; so that if the Supreme Power was to annihilate all the factitious saltpetre of France and Germany, Spain alone could supply the rest of the world, without the aid of a fixed alkali, ashes, or vegetables, if public economy joined hands with industry, and assisted in bringing these great points to perfection. I once asked one of these people the reason of that constant production of saltpetre; but his only answer was, "I have two fields, I sow one with corn, and have a crop; I plough the other, and it furnishes me saltpetre!" [*Tech. Rep.*

On the Spanish Iron Ore of Mondragon, in Guypuscoa; with some account of the famous Toledo Sword-blades, so greatly valued formerly in England. By Don Guillermo Bowles.

"I shall now relate some particulars concerning the famous iron mine of Mondragon, which is about a league distant from the town of that name, in Guypuscoa. It is called by the Spanish miners, '*Hierro Elado*,' or frozen iron; is found in a red clay, and produces *natural steel*, with this remarkable circumstance, that it is not to be met with any where else in the kingdom. They even preserve a traditional story, that this ore was used for those famous swords, which Catharine of Arragon made a present of to her consort, our Henry VIIIth; some of which still remain in repute in the highlands of Scotland, being suitable to their dress, and are called *Andre Ferrara*, the name of the maker, which is marked on the blades. *The famous Toledo blades*, those also of Zaragossa, called *Del Perillo*, mentioned in Don Quixote, and others, from the figure of a little dog on the blade,* were also supposed to be made of the ore of this mine, which yields forty per cent. of metal, though rather difficult to fuse.

* Cervantes endeavours to heighten the courage of Don Quixote, when he attacked the lion in the cage, by adding, "that his sword was of the common sort, and not so sharp as those famous ones with the *Perillo* mark." The Zaragossa artists had three distinct marks on their blades, viz. *El Perillo*, a little dog; *El Morillo*, a Moor's head; and *La Loba*, a wolf. Swords with the *Loba* mark, have the name of *Andre Ferrara* on them, and are not uncommon at this day in England. They show a sword in the small armory of the tower of London, with the name of Andre Ferrara, and no other mark, which was taken in the Scotch rebellion, in 1715.

Good steel may be obtained from it with very little trouble, because the iron has in itself the proper disposition to receive, in the furnace, the necessary carbon to make excellent blades; but without cementation, it perhaps may not answer for files or razors.

"These blades were generally broad, to wear on horseback, and of great length, suitable to the old Spanish dress; but this being altered, when the Duke of Anjou ascended the throne of Spain, the French swords were introduced with their dress, which even now is commonly called in Spanish, a military dress, *vestido de militar*, in opposition to the long black cloak, universally worn there before that epocha. So that the old Toledo blades fell into disuse, and the manufacture declined; but a new manufacture of sword blades has since been set up at Toledo, for the use of the troops, and they are said to be as well tempered as the old ones, and are able to bear most extraordinary proofs; but these are not made of the ore of Mondragon.

"There are various opinions relating to the old blades we have been speaking of; some say they were only tempered in winter; and when taken out of the forge for the last time, were vibrated in the air in the coldest weather; others relate, that they were heated till they acquired that colour called *cherry-red*, and then were steeped in a tub of oil or grease, for a moment or two, and then plunged in the same manner into warm water, all which was done in the depth of winter. Others will have it, that they were made of the natural steel of Mondragon, with a list of common iron in the middle, to make them more flexible; and were then tempered in the common manner in the winter season. Such are the prevailing opinions about the blades of Mondragon, which are certainly excellent; but as to the present workmen of Mondragon, or in any part of Guypuscoa, they are yet unacquainted with the secret of converting iron into steel, or tempering it properly; and even in the making of tools, are far inferior to the artists of England.

"It is somewhat particular, that to this day, they have no other word in the Spanish language for a brick-horn, or a bench-vice, than *Vigornia*, the Latin name for the city of Worcester, thought to have been once famous for works of that kind.

"As many of the most capital workmen of Toledo quitted that city on the decline of their trade, and settled in different parts of the kingdom, where they supported the reputation of their art; and as their blades have since been dispersed all over Europe, those who are curious in these matters, will, perhaps, not be displeased to see a list of their names; as by this means they may know them whenever they fall in their way:—

Bilboa, - - - - - -	Pedro de Lagaretea,
Orgaz, - - - - - - -	Pedro Lopez,
Lisbon, - - - - - -	Melchior Saanz, Juan Martinez Machacha,
Seville, - - - - -	Sebastian Hermandez, Pedro de Lezama, Juan Martinez el Mozo,

Madrid, - - - - - -	Francisco Alcocer, Dionisio Corrientes, Antonio Ruiz,
Cuenca, - - - - - - -	Julian Garcia, Andres Herraez,
Valladolid - - - - - -	Juan Salcedo,
Calatayud, - - - - - - -	Luis de Nieva, Andres Munester,
Cordoba, - - - - -	Alonzo Rios,
Zaragossa, - - - - - - -	Julian de Rey,
San Clemente, - - - - -	Lopez Aguado,
Cuellar and Badajoz, - - -	Bartholome de Nieva, Calcado, Campanero.

" *The following workmen still remained in Toledo*:—

Zamorano,
Thomas de Ayala,
Juan de la Horta,
Francisco Ruiz and sons,
Juan de Vargas,
Juan de Luizalde,
Francisco Lardi,
Andres Garcia,
Heras, father, son, and grandson,
Alonzo de Sahagun and sons,
Fernandez,
Martinez.

" Any old blades found with these last names, may be undoubtedly considered as true Toledos, and executed by the most capital artists.

" Cervantes further relates, that Ramon de Hoces was famous at Seville for making of poniards. Nor should I forget the famous *Montante* of Spain, a huge weapon, used with both hands at once, so well described by Milton, speaking of Michael's sword:—

> " With huge two-handed sway
> Brandished aloft, the horrid edge came down,
> Wide wasting."—PARAD. LOST. Book VI.

" In the king's armory at Madrid, besides many curious and complete suits of armour, they had a fine collection of antique swords; amongst the rest, those said to have belonged to the Cid, and Bernardo del Carpio; also the sword of Francis I., and that of John George, duke of Saxe-Weimar, taken from him by Charles V., at the battle of Horlingen. The swords of the Cid, and Bernardo del Carpio, were made at *Zaragossa*; but that of Francis, at Valençia, as was the sword, likewise in the armory, of that famous hero, Garcia de Paredes, with his name on the blade, and on the other side, "*plus ultra operibus credite.*" Though these details may now, perhaps, be considered as of little moment, it was not so with our ancestors, who set a high value on these Spanish sword-blades, particularly

the Toledos; as may be collected from various passages in our favourite writers,—Shakspeare, Johnson, and Butler."

On the German Polish for Wood.

From information derived from Mr. Joseph Clement, the celebrated engineer, we were the first to publish any accurate information on the *French polish* for wood, now become so universally employed, and have continually added, from time to time, such further particulars thereon as have come to our knowledge.

Our scientific friend, Mr. J. I. Hawkins, however, having lately returned from Vienna, where he saw this process performed by an excellent workman in the cabinet-making line, and where it was invented forty years since, has kindly furnished us with such valuable information on *their superior method* of performing it, that we lose no time in communicating it to our readers.

The wood having been planed flat, and finished with the steel scraper, as in the usual processes for the French polish, has its surface evened as follows: two pieces of pumice stone, having been previously rubbed flat, are then to be oiled, and rubbed against each other, until they have acquired a uniform or even surface. The wood is then to be well rubbed with these, first longitudinally, then across, and, finally, in a spiral or circular manner, always obliterating or removing the scratches or marks made by the former rubbings, before finishing the succeeding ones; in this manner the wood will likewise receive a uniform surface, and will become ready for the application of the varnish.

The Germans never use any other varnish, than a rather dilute solution of seed-lac, or shell-lac, in alcohol, for their *polish;* and, indeed, the addition of any other material would only injure *the great hardness of the lac varnish.* If the varnish be required of *a lighter colour* than usual, in this case the clearest grains of lac ought to be selected in preference.

The varnish is applied in the following manner. A piece of *sponge* being wetted with the varnish, is to be laid upon *five pieces of linen rag*, the borders or edges of them being gathered together at the back, to serve as a handle to this rubber. When the varnish has penetrated all through these different thicknesses of linen cloth, a little linseed oil must be applied in the midst of the varnish. *The whole extent of one surface of the article to be polished, must then be gone over at once*, with this rubber; the varnish being also applied, first in straight lines crossing each other, and then in spiral or circular ones, in the same manner as in the evening the surface of the wood; and fresh oil must be applied to the centre of the rubber, whenever a tackiness or adherence of the varnish is beginning to take place. If there are four or five different articles to be polished, each should be gone over in succession, in the above manner, and thus afford time for the varnish to acquire consistence, before applying another coat of it upon the former ones. In this way the process

must be continued, with the usual care and precaution, until it is thought that nearly enough varnish has been applied to the surfaces. One of the linen rags is now to be taken off, and the varnishing continued with the remaining four, with a renewed surface, and the application of the oil upon the outer one; this again is then to be removed in its turn, and the process carried on towards completion with three thicknesses only; then with two; and finally, with one thickness of linen only.

Should the varnish be required to be of any other colour than that afforded by the lac, it may be *reddened*, by filing a little *Brazil* wood, and sprinkling the sponge over with the dust; changed *yellow*, by treating *turmeric root* in the same manner, and so with other tinging woods, the colour of which is capable of being brought out by the action of alcohol upon them.

Should, however, it be required, that *a still more durable polish* be given to the wood; then the above process must be repeated at the end of two days after the first polish has been given to it; next, in the course of a week; again at the end of a month; and lastly, at the end of three months; thus always allowing due time for the previous coats to become sufficiently hard, before applying the succeeding ones. In this manner, instead of having to lament the quick disappearance of this beautiful polish, as in the ordinary French method of doing it, we may calculate upon its enduring for years.

The German cabinet-makers do not merely content themselves with polishing the exterior of their works, but extend this beautiful improvement to the drawers, partitions, and every other part of their interior fittings also, with great addition to their value; and indeed they also take much more care in the finishing of their woods generally, than we are in the habit of doing. [*Tech. Rep.*

Observations on the manner of Manufacturing Indigo in the Southern Provinces of India; with some Remarks on its Chemical Changes and Combinations. By CHARLES H. WESTON, Esq.

(Concluded from page 238.)

WITH such a view of the important changes which thus occur, we see that, chemically speaking, there is no such difference in the two processes as we might be led to imagine from the varied manner of *manufacturing* the indigo. The silent and gradual change which passes upon the dried leaves in the storehouse, is precisely analogous to the absorption of oxygen which precedes, and, in this instance, continues to be simultaneous with fermentation.* It might be fur-

*Although vinous fermentation can be carried on completely excluded from the atmospheric air (*Vide* Brande's 'Manual of Chemistry,' vol. iii.) this does not seem to be the fact in the present case of common fermentation, or partial decomposition. Dr. Bancroft, in his first vol. p. 185, writes,—"But it was fully ascertained by Dr. Roxburgh, that a copious *absorption* of air from the atmosphere did occur; and that oxygen did combine with the basis of indigo in a considerable degree *during* fermentation, was manifested by the progressive changes which, as usual, constantly took place in the colour of the liquor

ther remarked, that the injury, arising from keeping the leaves after the acquirement of the "lead colour," to which I have before alluded, has its parallel in the injury sustained by excessive fermentation in the Bengal process. The period, during which the leaves are kept, appears, indeed, to be the only time in which the leaves could have received oxygen to *such an extent;* because, during the growth, as long as the sun's rays are exerting their direct influence upon them, they copiously give out oxygen gas, and, during the absence of the sun, the exhalation of carbonic acid gas, necessarily employs another portion of oxygen.*

Before quitting this part of the process, I will here state another experiment on the solution of *green* leaves in cold water, because, while it at first appeared completely to upset the conclusions I had deduced from former experiments, it did, upon subsequent consideration and examination, strongly confirm the truth of them.

Green leaves steeped in *cold* water for fifteen minutes began to tinge the water with a *greenish* yellow. Leaves from the same plant, after five hours' boiling (the loss of water by evaporation being constantly supplied,) gave out a proper extract of indigo; and from another portion of leaves, after twenty-four hours' digestion in *cold* water, the *whole* of the indigo was precipitated, and the supernatant liquor clear, and of a good "brandy colour." These were unexpected results, and they seemed to throw a doubt over the consequences of every one of the former experiments: my first inquiries and examination were, therefore, directed to the plants from which the leaves had been taken. I found the plant had been cut *one month* previously, and that the leaves were some few under leaves remaining on each plant of the *former* crop. Now, as the leaves had become ripe one month before, they had arrived at, and passed, the maximum capabilities of their physical powers; and their organs had long ceased to perform their proper functions in decomposing carbonic acid, and of exhaling oxygen gas. We know that fruit, when ripening, absorbs oxygen,† although allowed to remain on the tree, and the same tendency doubtless exists in the whole vegetable world in a greater or less degree. The leaves subjected to the above experiment had assumed a much darker green than leaves possess at the proper time for cutting, and as they had passed beyond the full period of strength and health, they could have no other tendency but to absorb oxygen.‡ They had then, consequently,

during the fermentation until it acquired a full green, and even a bluish colour, the froth, or scum, becoming, more or less, blue at the same time." See, also, p. 176.

* I have qualified this remark by adding, "to such an extent," because it is not intended to intimate that either during the day or night the balance of oxygen is not *in favour* of the plant. The contrary, in both cases, is clearly proved by the experiments of Saussure, as mentioned in Thomson's 'System of Chemistry.'

† M. Berard of Montpellier has showed that fruits, in ripening, convert the oxygen of the air into carbonic acid.—DAVY's *Agricul. Chem.* See, also, Dr. SMITH's *Botany*, p. 155.

‡ *Vide* Sir H. DAVY's *Agricul. Chem.* p. 207—209.

been undergoing, for at least three weeks, the same process, though perhaps in a less degree, which the leaves in the warehouse had experienced, and had absorbed on the plant, that given quantity of oxygen which is necessary to render the colouring matter of the leaves soluble in water. Such a view of the subject reconciles all apparent difficulties.

The difference in the effects of ebullition upon the green leaves, in Experiment No. 4, and upon these in the last experiment, in reference to extent, can be easily explained, on the supposition of a previous absorption of oxygen; since, within certain limits, matter has its affinity for oxygen increased in a kind of geometrical ratio by the previous absorption of oxygen.

From this last experiment we get possession of this important fact, that in practice, the age of the plant, and the time for keeping it, should always be in an inverse ratio; that is, *if from fear of rain the plant be cut too soon, the leaves should be kept a little longer; and if from want of sufficient sunshine the cutting be deferred till after the plant is fully ripe, the leaves will not require to be kept so long.*

We now suppose the indigo leaves, after their due keeping, ready to be transferred to the "steeping vat,"* where they are commixed with water, in the proportion of about one volume of leaves to six of water, and allowed to remain for two hours. The great affinity of indigo for oxygen is here very manifest, in the quick change of the colour of the leaves which float on the surface, and are exposed to the action of the atmosphere, to a blackish blue, when contrasted with those below which remain unchanged. On this account the vat is, every now and then, "turned," that is, the floating leaves are immersed. This steeping part of the manufacture constitutes the characteristic difference between the green and the dry process. In this instance, it is a simple *infusion* of the leaves without fermentation; in Bengal, the branches, together with the leaves, are steeped and allowed to *ferment*.

After two hours' infusion, the water, which, from the solution of imperfectly-oxygenized indigo, has acquired a fine green colour, is allowed to run off from the leaves through strainers into the "beating vat." Two hours are generally supposed to be sufficient to extract all the colouring from the leaves, and the following experiment seems to confirm this supposition.†

"Refuse leaves of indigo taken from the vat, and quickly rinsed,

* A vat is an uncovered reservoir, built of brick, and lined with stucco prepared from burned shells; it is usually about thirty feet square, and twenty-six inches deep.

† Whatever may be the necessity of making use of *hot* water for obtaining indigo from the leaves of the nerium tinctorium, or the advantages to be derived from its use in the fermentation of the indigofera tinctoria, which Dr. Roxburgh mentions, no possible advantage can be derivable from such management in the dry process; because, as we find that the solvent power of cold water is quite sufficient to extract the whole of the blue colouring matter, an increase of that power, by the addition of caloric, could only have the effect of dissolving other substances which are foreign to the dye.

to remove any indigo externally adhering to them, were digested in cold water for one additional hour. They gave to the water a pinkish colour, but no *green* tinge, from which was obtained, by a solution of acetate of lead, a delicate whitish yellow precipitate." My observations, of course, refer to leaves properly kept and properly dried; because, if prematurely put into the vat, the time necessary for the entire extraction of the indigo would be much greater. But the green liquor cannot be allowed to remain so long upon the leaves, because a partial precipitation of indigo would take place before it passed into the beating vat.

In the beating vat the solution is agitated by the paddles of ten or twelve natives for about two hours, during which time the fine green liquor gradually darkens to a blackish blue. No precise time can be laid down for the continuance of this part of the process, as the absorption of oxygen, which is thus effected, and hastened by beating, and the consequent continual exposure of some new portions of the liquor to the atmosphere, depends on circumstances, such as the former preparation of the leaf, and the immediate influence of the sun.*

The only criterions to guide us, are—the peculiar black hue of the liquid, the whiteness of the froth thrown up by beating,† and the incipient separation of the particles of the indigo. This last effect can be easily seen by placing a small quantity in the palm of the hand, and more distinctly by pouring some into a white plate.

At this time lime-water is thrown into the vat, and well immixed with the liquor. The whole is then allowed to rest for three hours, and the supernatant liquor, which is, or ought to be, of a fine bright Madeira colour, is allowed to run away from the precipitate, by cocks placed at different heights. The indigo is then removed from the vat to the covered part of the manufactory called the laboratory, where it is put on a strained cloth, and allowed to drain throughout the night.

But as the beating process is the most material part of it, so it is here that we most sensibly feel any improper management with regard to the leaves. Premature cutting of the plant, imperfect desiccation of the leaves, and even the previous occurrence of much cloudy weather, while the plant was growing—show their bad effects in the necessity of a much more lengthened beating, and in imparting to the froth a green colour, which, otherwise, as the oxygen was absorbed, would, by a precipitation of the indigo, have become white. When the two first evils are to a greater extent, no beating will precipitate all the indigo, and, consequently, much will be lost. The supernatant liquor, instead of being of a fine Madeira colour, will remain a dark, dingy Madeira colour.‡ The following experiments will give force to this observation:—

* It has been before remarked that the vats are uncovered, and therefore exposed to the direct rays of the sun.

† This must be regarded with some limitation, as we shall see soon what will prevent sometimes the whitening of the froth.

‡ Dr. Bancroft confirms this remark.

"A quantity of Madeira colour liquor left after the manufacturing of indigo improperly dried, was reduced by boiling to one-third its bulk. The colour was deepened, and the smell of it highly saccharine, and *blackish indigo was precipitated.* At this time the yellow extract of the liquor appeared to begin to separate. The liquor, after the removal of the precipitated indigo, was boiled for other seven hours, supplying the loss occasioned by evaporation: *more indigo* was precipitated, combined with some of the extract."

Again, "Another portion of the Madeira colour liquor was first exposed to the action of the atmosphere for seventeen hours, and then beaten for two hours. The solution became greenish by the additional absorption of oxygen, and a *little indigo* was precipitated."

As, therefore, the quantity of the precipitation depends upon, and is in proportion to, the oxygenation of the indigo, the importance of carrying on this beating process to its maximum to obtain the whole colouring matter is evident; but there is another extreme to be avoided.

When indigo is combined with a certain quantity of oxygen, its colourless base acquires a blue colour; but after this point is passed, and a further combination of oxygen has taken place, the colouring matter passes from a blue to a blackish-blue, and the indigo is technically said to be "burnt." If beating be carried on still further, the granulated indigo becomes specifically lighter, and a partial resolution of it follows, and it is therefore unavoidably lost. Each of the different effects here mentioned will be more clearly pointed out and understood, by perusing the following memorandum:

"A green solution of indigo from the vat was agitated for ten hours. The supernatant liquor, instead of being a fine clear Madeira colour, became like burnt umber—resulting from a partial resolution of the indigo. The indigo became specifically lighter, and remained floating in the menstruum. The whole was filtered, and the indigo properly pressed and dried, and the cake when broken was *black.*"

Beating, strictly speaking, is not essentially necessary to the formation of indigo, but is rendered expedient by the *accumulation* of the green solution in one place, and the consequent non-exposure of a great part of it from the influence of the oxygen of the air.* I make this remark, because I have found that portions of the green liquor could be *completely* oxygenized by bare exposure to the atmosphere, without agitation. "Made a solution with indigo leaves, filtered it, and divided it into two equal parts, one part of which (No. 1.) was exposed to the direct influence of the sun's rays, and the other (No. 2) was kept in a dark place. The first portion was considerably in advance of the other throughout the process, so that

* This remark will serve to render evident the expediency of precipitates, although, as we shall soon see, they be not necessary in the small way. Dr. Roxburgh well describes their utility, when he says:—"If well chosen, and in proper proportions, they forward the operation *much,* causing a *larger* produce than could be had without them." His advice as to the time for using them, is worthy some attention.

when No. 1, in two hours and a half, was completely precipitated, leaving the supernatant liquor a fine clear Madeira colour, No. 2, in the same time, was but partially precipitated, and the supernatant liquor remained greenish. After longer exposure, however, the whole indigo of No. 2 was also precipitated."

By this experiment we learn, not only that a complete precipitation can take place without beating, but without the assistance of lime-water. We also learn that sunshine can hasten the beating process, as I before remarked; the great affinity of indigo for oxygen enabling it to separate and combine with that gas, which always co-exists with the least refrangible rays of light.*

Having said thus much on this most important part of the manufacturing process, I shall now make some observations upon the yellow extract of the leaf, which has been denominated "the supernatant Madeira-colour liquor." We see that the indigo leaf imparts to water two distinct colouring matters—the blue and the yellow; and that a solution of the latter, when a complete precipitation of the indigo has been effected, is bright and clear. This extract appears to have many qualities in common with the blue. From experiments already detailed, it has, like indigo, an affinity for oxygen (although, indeed, in an inferior degree,) its colouring matter is capable of being deepened by the absorption of oxygen, and by a further absorption in part precipitated. Its affinity for indigo is also great, for it is always combined in some degree with the granulated indigo: and when the yellow dye ceases to be given out from it to *cold* water, *hot* water will extract another portion, as we shall by and by see; and again, after the whole process is completed, pounded indigo will afford more colour to boiling water.

I have found that a solution of acetate of lead will throw down from this Madeira-colour liquor a fine yellow precipitate; and that this, when filtered and gently dried, remained unchanged after an exposure to the air for nine months. But a more delicate yellow colour can be procured, by adding acetate of lead to a filtered green solution of indigo from the steeping-vat, when the indigo is first precipitated combined with the salt, leaving the supernatant liquor clear. To this solution, filtered, again add acetate of lead, and the precipitate will be a fine yellow, brighter than that separated by beating.

I endeavoured to fix that colour on cotton-cloth, and found that, by frequent alternate steeping the cloth in this Madeira-colour liquor, and drying it, and so saturating it with the colouring matter, and subsequently steeping it in a solution of acetate of lead, an insoluble precipitate was effected between the fibres of the cloth; and the yellow colour was imparted. But I have not followed up this experiment, and therefore can say nothing of the permanency of this colour alone, or when protected by an after dip in the blue vat for obtaining a green; or how the colour may be affected by aluminous

* *Vide* "Light and Caloric."—THOMSON's *Syst. of Chem.*, and URE's *Chem. Dict.*

and other mordants. I have nevertheless thought that some notice should be taken of this experiment, imperfect as it really is, that it might serve as a hint to some scientific indigo-planter, whose numerous opportunities will enable him to try whether the immense quantities of colouring matter now daily allowed to run to waste can be turned to any advantage.

I have said that the indigo leaves produce two dyes—the blue and the yellow; strictly speaking, however, there is yet another colour which may be thus obtained. The refuse leaves taken from the vat, and well washed, to remove all colouring matter adhering to them, when boiled for an hour and a half, will render the water yellow, tinged with green. This water, kept in full ebullition for two hours (supplying the loss occasioned by evaporation,) will, when filtered, afford a precipitate, which, when dried, will in colour be a dun-slate, and in quantity perhaps about equal to the blue extract such leaves have produced. This observation, as it can lead to no practical advantage, is made for the man of science, rather than the man of business. The precipitate appears to be very impure, and mixed with some of the finer parts of the fibres of the leaves.

We now revert to the manufacturing process. The precipitated indigo left in the vat was transferred to the cloth-strainer within the laboratory, and allowed to drain throughout the night. On the following morning, the indigo is put into the copper, with a quantity of hot water, and raised to ebullition. As the mass is gradually heating, a quantity of scum rises, which is immediately removed, and as soon as the whole is brought to the boiling point, the fire is withdrawn. The contents of the copper are retaken to the strainers, and the drained indigo is then divided into small portions, and each portion well worked by the hands of the natives. This manipulation is continued till the indigo be freed from air-bubbles, and has assumed a close, fine, and smooth appearance. The whole is then carried to the pressing-boxes, which are usually square, and of sufficient depth to leave the cake about two inches and a quarter in thickness. By means of a powerful screw, the water is separated from the indigo, which is then left in a large square cake. This is subsequently cut into small cakes, which, gradually dried in the shade, and carefully protected from the hot land-winds, are thus rendered fit for exportation.

This last part of the process I have described as succinctly as possible, because I felt I was travelling over a path already well trodden; but I could not wholly pass it over, as I wished to make some observations upon the *uses* and *effects* of boiling, as they have occurred to my mind, and which I have not seen mentioned in any work upon indigo. Dr. Bancroft, indeed, speaks of boiling indigo in copper vessels, but this was boiling indigo in a weak solution of soda, for the *sole* purpose of removing impurities, and, therefore, differs from that we are now considering.

The first effect of boiling appears to be *a condensation of the particles of indigo*, because I have found that the aggregate quantities of indigo and water, when taken out of the copper, show a much

greater deficiency than could possibly, I think, have resulted from loss by evaporation.

Another advantage arising from boiling, is, I should say, the *removal of much extraneous colouring matter* from the indigo. I have before observed that the affinity between the yellow dye and indigo is such, as always to combine with the precipitated indigo. Cold water, whether affused over, or digested upon, this precipitate, extracts no colour, but the hot water in the copper is always as strongly tinctured with the brandy colour as the supernatant liquor of the heating vat.

Another advantage derivable from partial boiling is *an improvement of the hue* of the indigo, occasioned, I infer, by an additional absorption of oxygen. Experience has shown the observant manufacturer, that indigo, when boiled, possesses a purplish hue, which indigo carried from the strainers to the pressing boxes does not possess; experiments before detailed, prove that oxygen is absorbed during ebullition, and even to such an extent as to precipitate indigo—and oxygen we know to be the direct cause of colour;—we may therefore fairly infer, that the improvement of tint in the copper is occasioned by its absorption. The following memorandum will perhaps throw some light upon this part of the process, and give us some caution as to the extent to which it should be carried:—

"Boiled indigo for seven hours after its own proper boiling, and constantly supplied the loss of water: thrown upon the filter, the separated liquor was a good brandy colour. The indigo pressed and dried proved to be a *dead* blue."

From this we learn, first, that after the fine purplish hue has been acquired, we have arrived at the maximum of improvement in colour, and that any further accession of oxygen deteriorates the colour. And, secondly, that the oxygen so absorbed by boiling, is in a proportion far less than during the beating process.*

Another use of boiling is the throwing to the surface a quantity of scum, which is usually said to consist of resinous impurities; but of this I would affirm nothing, inasmuch as I have never examined the chemical qualities and nature of this substance.

I have now given a pretty full account of the dry process of manufacturing indigo; in detailing which, my object has been to give some chemical rationale of the different parts of the process, to venture suppositions respecting the nature of those changes to which the plant is necessarily subjected; and at the same time to point out the grand characteristic difference between the steeping and the fermenting modes of manufacturing.

This paper, I am aware, cannot be considered sufficiently comprehensive in matter, as it by no means imbodies the whole process, practical and theoretical; and I doubt not, but, to the chemist, many of the preceding pages afford abundant specimens of much that is superficial, both in observation and in scientific knowledge. I was,

* Compare this experiment with that in which the effects of excessive agitation were related.

however, alone induced to offer any remarks upon such a subject, from the conviction that the almost entire absence of information would give to them a kind of artificial interest which otherwise they could not have possessed. It is but justice, indeed, to myself, to add also, that these memoranda were originally never intended for the perusal of a second person, but that they formed the first experiments I ever made on the interesting properties of indigo. These I had fondly hoped, at some future period, to have extended so far as to give myself a full insight into the whole process, for much additional examination is absolutely necessary. Some of the advantages, for example, of boiling the indigo, as they have struck my mind, have indeed been alluded to, but more experiments and closer attention may bring to light other, and, perhaps, more important effects, than some of those already mentioned. So, also, with respect to the other parts of the process, which I consider rather as an outline to be filled up by future observations. With proper apparatus, and a little perseverance (as almost every part of the manufacture may be conducted under receivers, &c.) not only may the nature of the changes which are constantly taking place be clearly and unquestionably explained, but the quantities of gases absorbed and evolved be correctly ascertained.

Circumstances have prevented the possibility of my renewing such delightful employments; I therefore leave my observations, unsatisfactory as they may be, as hints to others, who may have both opportunities and abilities to investigate the subject throughout all its bearings. [*Quarterly Journal.*

On the Early History of the Steam Engine.

A paper on this subject, and particularly on the rival pretensions of France and Great Britain, published by M. Arago, in the "Annuaire du Bureau des Longitudes" for 1829, has excited more attention than might have been thought due to so hacknied a topic. The cause of that attention will, perhaps, be found in the preface by which the paper is introduced, and of which the following is a translation.

"The steam engine has rendered such important services to industry and navigation, that we cannot be astonished at the eagerness with which various nations have disputed the honour of the invention. Yet it will not be heard without surprise, that in England alone one hundred thousand copies of the works in which this historical question is discussed, have been sold within a very few years. Such striking success is due, I doubt not, principally to the lively interest which the steam engine must naturally excite in a country where it is met with at every step; but may we not suppose that self-love has had some share in producing this effect? Ask the member of the House of Lords, and the most simple artisan; the merchant whose speculations have led him into every region of the world, and the farmer who has never passed the borders of his own county; traverse

the manufactories of Birmingham, Manchester, and Glasgow, and the humblest workroom of a cottage; every where you will hear that the first inventor of the steam engine was the Marquis of Worcester. Every where this name will be cited, and it will be followed by those of Savery, of Newcomen, of Beighton, of Watt, of Hornblower, of Woolfe, &c. &c. Literary men, and those who cultivate the sciences, have, in general, opinions no less decided. If you open the recent Encyclopædia of Dr. Rees, you will find this passage; 'the steam engine follows next to the ship in the order of inventions, but in an English Encyclopædia it will take the lead, from the circumstance of its being wholly invented and brought into general use by our own countrymen.' And then, as if this were not sufficiently clear; 'the steam engine has been invented by a small number of individuals, all of them Englishmen.'

"The celebrated professor John Robison, of Edinburgh, is quite as positive. He says, 'the steam engine was, beyond all doubt, first invented by the Marquis of Worcester, in the reign of Charles the Second.' Then, after having refuted by arguments, which I will examine, the pretensions of those French authors who affect to mix up the name of Papin with the history of the steam engine, Robison declares, 'that he does not hesitate in giving the honour of the first and complete invention to the Marquis of Worcester.' A philosopher, not less illustrious for the profoundness of his knowledge, than for the vastness of his erudition, Dr. Thomas Young, has joined his imposing testimony to those I have quoted. According to him, the Marquis of Worcester is the first inventor of the steam engine, the first who has used the pressure of vapour as a prime mover. In the rapid view which he takes of the ameliorations which this machine has successively undergone, no names appear but those of Englishmen. I could also cite the able professor of Mechanics at the Royal Institution, Mr. Millington; a distinguished member of the new University of London, Dr. Lardner; the author of an esteemed Treatise on Mechanics, Mr. Nicholson, &c. &c.

"Decisions so numerous, so positive, the just reputation of the works from which I have quoted them, would seem to exclude the shadow of a doubt. When, therefore, at the desire of the pupils of the Polytechnic School, I attempted, some years since, to trace the chronological series of improvements in the steam engine, from its origin till our own time, I expected, I say it without equivocation, to have only English mechanics to cite. This was, however, a mistake. Our neighbours on the other side of the channel are not the sole, neither are they the first, inventors of the steam engine."

The last paragraph of this preface will explain the reasons for the extraordinary notice which has been taken of the paper. It has been supposed that the dispute was as new to every body, as M. Arago describes it to have been, a few years since, to him. But the fact is, that the dispute, if it may be so called, is as old as the steam engine itself, and it has been kept constantly alive for the last hundred years, as every one acquainted with the works of Belidor, Bossut, Montgery, and many others on the continent and in England, must

be fully aware. The first of these writers alludes to it in his "Architecture Hydraulique," published in 1725, and concludes thus: "a proof that the steam engine had its origin in England, is obtained from the fact, that all the engines erected out of England have been the work of Englishmen." After this testimony by a Frenchman, writing when the facts were fresh in the recollection of the scientific world, it is almost too much to charge all the English writers (one only excepted) with having sacrificed the truth to their national prejudices; and especially when this is coupled with such an extraordinary demand on their credulity, as is made by the assertion that *a few years since* M. Arago imagined that none but English names had been associated with the history of the steam engine. If M. Arago were thus ignorant of the facts, the circumstance is evidence of suppression or neglect, not so much on the part of the English, as on the part of the French writers, who on this subject are numerous and voluminous, and with whom M. Arago could not have been unacquainted. If, a few years since, M. Arago did not know that France had produced the steam engine, we may presume that it was a fact not generally known in France. If, then, France had forgotten her own work, England might have been pardoned for not recollecting it.

The best reply to M. Arago's paper will consist in a brief exposition of every known step in the application of elastic vapour to the production of motive forces; from which may be deduced the real value of those facts which the English are incorrectly charged with suppressing, and from which also will be seen how unnecessary was the following declaration of M. Arago: "Mes citations, mes analyses, seront exactes; on peut y compter." It is not usual for scientific writers to premise that they are not going to falsify their extracts; the name of M. Arago would have been considered a sufficient security against such a proceeding. It will, however, be found in the sequel, that some of the *citations* are not quite *exact*, and that the variations are always in favour of the writer's hypothesis; but it would never have been supposed that the variations were made designedly, even without the singular protestation before quoted.

The earliest known suggestion for the use of steam, is one made about one hundred and thirty years before Christ, by Hero, of Alexandria, and published in his "Spiritalia." Its principle and mode of action will be understood from *Fig.* 1, where *a* represents a globe moving freely on its axis in such a manner as to permit the constant introduction of steam from a detached boiler. The steam escapes through the bent tubes *b*, *b*, and gives, by its reaction, a rotary motion in the direction of the arrow.

Fig. 2, describes another apparatus of Hero, in which *a* is a globe half filled with water, which is partly converted into vapour by exposure to the sun. A pressure is thus occasioned on the surface of the water, which is consequently driven up through the syphon *b*, into the cup *e*, whence it descends by the pipe *d*, into the close vessel *c*, also half filled with water. When the globe *a* cools, the water it contains is relieved from the greater part of its pressure by con-

densation, and the water rises from the vessel *c*, through the pipe *f*, to supply what had been driven over by the elasticity of the vapour. Thus the water is alternately expelled from, and restored to, the globe, by the alternate production and condensation of elastic vapour.

Fig. 1.

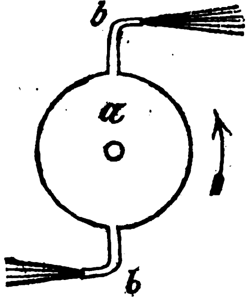
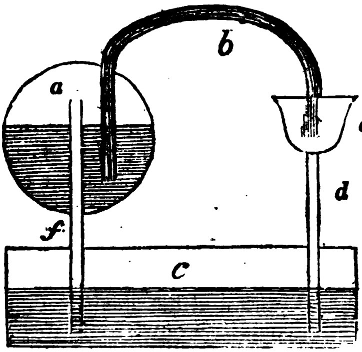


Fig. 2.

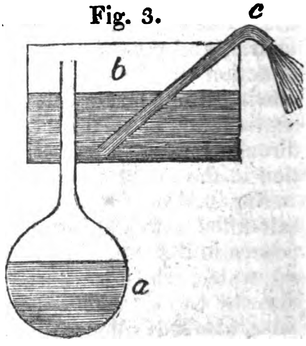


It is obvious that the engraving in this case is a mere diagram; that the apparatus would require a valve opening downwards in the pipe *d*, and another opening upward in the pipe *f*. They are omitted in Hero's diagram, most probably for the reason, that the use and application of such valves were then too well known, and too obvious to require notice.

The first of the two contrivances above given, is quoted by M. Arago. The second he omits, though both are contained in all the editions of Hero's well known treatise. In this case, therefore, the *citation*, if not *inexact*, is *incomplete*, and it happens that the second apparatus anticipates the principle of both the contrivances on which M. Arago builds his theory, that the steam engine is a French invention.

A translation of the work of Hero was published in Italian, by Baptista Porta, in 1606. He repeats Hero's inventions, and adds the following of his own, illustrated by a diagram, in which is shown the furnace for heating the water. In *Fig.* 3, the furnace is omitted; in other respects it is a copy from the work of Porta. The boiler, *a*, has a long neck, which passes through the bottom of the close cistern *b*. A bent pipe or syphon, *c*, is closely fitted into the top of the cistern, and descends nearly to the bottom. When the fire is lighted under *a*, the steam ascends into the cistern, presses upon the water, and forces it up the syphon, *c*, whence it runs in a stream.

Fig. 3.



This is altogether a very extraordinary suggestion, and considering how well known must have been the works of the celebrated Baptista Porta, it is surprising that the project was not sooner reduced to practice than is found to be the case. The contrivance is a great improvement on that of Hero, (not because artificial heat is employed, for it is obvious that Hero proposed to use solar heat, merely for the sake of variety, but) because the steam from heated water in one vessel is made to drive up cold water from another vessel; instead of driving up the heated water from which the steam is produced. With this important modification, the apparatus resembles that proposed by the Marquis of Worcester, in 1663, excepting only in the extent of its power. The difference is merely one of degree. Porta's drawing and description, put into the hand of any intelligent workman, could not fail to realize all that the Marquis of Worcester hinted at in regard to the steam engine.

This apparatus of Baptista Porta is neither described nor alluded to in the paper of M. Arago, which professes to give every suggestion of importance; of course it was unknown to him; but he cannot avail himself of this apology without recollecting that English writers on the steam engine might have had the same apology for omitting French contrivances, which he must resort to for neglecting that of an Italian. It is not admitted that the English writers have omitted to notice any French invention of the slightest consequence; but if they had, the case of M. Arago and the Italian, will, for the future, suggest to him other causes for such an omission than national prejudice and self-love.

Only nine years after the publication of the work of Baptista Porta, that is to say, in 1615, appeared a treatise on *Moving Forces*, and especially on the means of raising water. The author does not profess to give new inventions, nor is there the slightest reason for ascribing to him *that* which will presently be considered. He says, "there *are* five means of elevating water above its level," which means he then describes, and which were then all of them old, most of them 2000 years old. They are, in fact, brought forward as *existing* inventions, and some are expressly referred to their authors.

The *first* mode of raising water, he says, is by the syphon. This instrument was older than Hero.

The *second* is by the well known operation of capillary attraction.

The *fourth* is by the action of compressed air, illustrated by Hero's fountain, and ascribed to Hero.

The *fifth* is by animal labour applied to machinery, such as the screw of Archimedes, or the pump of Ctesibius.

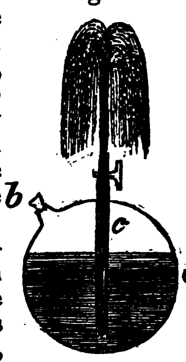
It would evidently be absurd to call the writer of the book in question the inventor of any of the four apparatus above described. He himself makes no greater claim to the third than he does to the others, and the works of Hero and Porta show that he *has* no claim; yet it has been very improperly conceded to him by several English writers;—by several of those writers whom M. Arago charges with suppressing the evidences of the French title. The reader will guess that the work above quoted is a French work, and that we now ap-

proach the period at which France invented the steam engine. The work was written by Salomon de Caus, whose name and pretensions were familiar as household words to the English, through the medium of English books, for years before M. Arago rescued them from the oblivion in which he says English prejudice had buried them. But to return to the fact, that the steam engine is on the point of being invented in France by Salomon de Caus.

The invention of this mighty agent, and its announcement to the world, fully justify the epithet which M. Arago gives to the inventor, when he calls him the "modest Salomon de Caus."

The announcement forms the *third* of the means which De Caus says *are* in existence for raising water.

Fig. 4.



"The *third* means is by the aid of fire, for which various machines may be made;" and he proceeds, "I shall here give the demonstration of one. Let there be a globe, *a*, having a valve, *b*, to introduce water, and a tube, *c*, soldered into the upper part of the ball, and descending nearly to the bottom; after having filled the ball with water, and well closed the valve, place it on the fire; then the heat, acting on the ball, will cause the water to ascend through the tube, *c*."

Nothing can be better than this as an illustration, in a general treatise, of the means by which water may be elevated; and nothing could be more ridiculous than to put this forth in 1615 as an invention; for, during the previous fifty years, Europe had been deluged with translations of Hero, and only nine years before had appeared a full description of the apparatus of Porta, to which this is so obviously inferior, that it would be an insult to the reader to say why.

It must, however, be recollected, that Salomon de Caus is not himself chargeable with the absurdity of calling this contrivance either new or useful; he most probably omitted the cold water vessel of Porta, because he equally well explained what he wished without it; namely, the simple and well known fact, that the elastic power of steam might be used to raise water.

It is scarcely credible that the hot water fountain described in *Fig.* 4, neither possessing nor pretending to the slightest feature of novelty or utility, is what M. Arago calls the invention of the steam engine in France, and the publication of which, by de Caus, entitles him to be called "un homme que la postérité regardera, sans doute, comme le premier inventeur de la machine à feu."

This case, as far as regards the claim made in behalf of France and de Caus, may now be left to the reader; but it remains to consider it in reference to M. Arago's protestation, "mes citations seront exactes, on peut y compter."

The diagram, *Fig.* 4, is accurately copied from the work of de Caus; the diagram given by M. Arago as an extract from the same work, is represented in *Fig.* 5, where it will be seen that the tubes *b* and *c* are indefinitely elongated, and the jet of water omitted. This is, of course, an accidental variation, but it renders the assertion of M. Arago, that the apparatus is a "proper machine for draining," a little less amusing than it would have been without this example of the *exactness* of the *citations.*

Fig. 5.

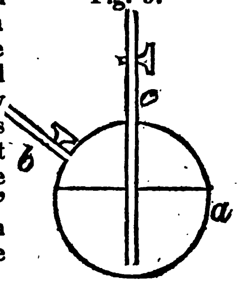


Fig. 6.

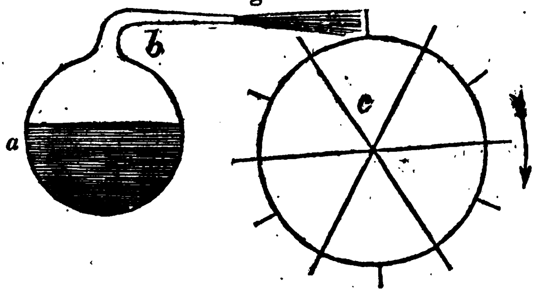


Fig. 6 describes an apparatus proposed in 1629, by Branca, an Italian. The boiler, *a*, terminates with a bent tube, *b*, from which the steam issues, and impinges upon the vanes of a wheel, *c*, which receives motion in the direction of the arrow. There is very little novelty in this contrivance; the principle does not differ from the first apparatus of Hero, and the practical effect would probably be inferior.

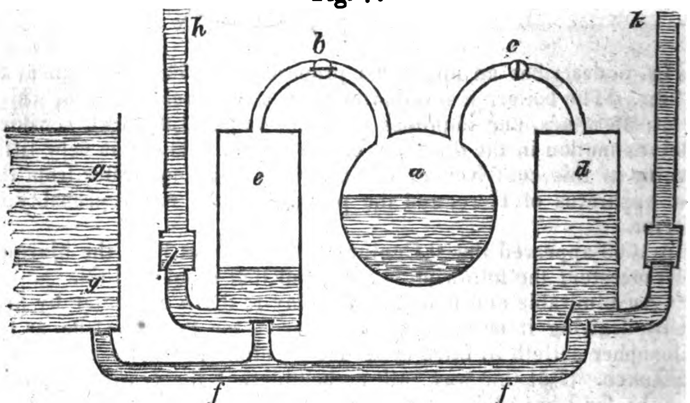
In 1663 appeared the "Century of Inventions," by the Marquis of Worcester; the following is a copy of that numbered 68.

"An admirable and most forcible way to drive up water by fire, not by drawing it or sucking it upwards, for that must be, as the philosopher calleth it, *intra sphæram activitatis,* which is but at such a distance. But this way hath no bounder, if the vessels be strong enough: for I have taken a piece of a whole cannon, whereof the end was burst, and filled it three-quarters full of water, stopping and screwing up the broken end, and also the touch-hole, and making a constant fire under it, within twenty-four hours it burst, and made a great crack; so that having a way to make my vessels so that they are strengthened by the force within them, and the one to fill after the other, I have seen the water run like a constant fountain-stream forty feet high; one vessel of water rarefied by fire, driveth up forty of cold water. And a man that tends the work is but to turn two cocks, that one vessel of water being consumed, another begins to force and refill with cold water, and so successively the fire being tended and kept constant, which the self-same person may likewise

abundantly perform in the interim between the necessity of turning the said cocks."

This apparatus, is, in principle, the same as Porta's. The merit of the Marquis of Worcester consists in having suggested the use of highly elastic steam, in exceedingly strong vessels, so as to raise water to a useful height, as forty feet. He has also the merit of urging the adoption of this plan on the large scale, whereas the schemes of Hero and Porta were mere experimental toys. It is most probable that the Marquis never tried this apparatus on a large scale, notwithstanding his assertion to the contrary; but that his description may easily be realized there is no doubt, though M. Arago denies it, and although he says that Mr. Stuart could not realize it, otherwise than by grouping together two of the vessels of Salomon de Caus, and working them alternately. Mr. Stuart's description is very incorrect, if it be as M. Arago states; for the globe of de Caus ejects hot water, whereas the Marquis of Worcester proposes that one vessel of *heated* water shall raise forty of *cold* water. This M. Arago insinuates it is impossible to do by adhering strictly to the description of lord Worcester. The annexed diagram appears, however, to realize all the conditions. Let *a* (*Fig.* 7,) represent the boiler communicating by the pipes *b* and *c*, with the cold water vessels *d* and *e*, which latter communicate by the pipe *f*, *f*, with the

Fig. 7.



water to he raised, *g*, *g*. The pipes *h* and *k* ascend to the reservoir, forty feet above, and their lower ends enter the cold water vessels *e* and *d*. The two cocks, *b* and *c*, are those which are described to be opened and shut alternately. The four valves in the pipes *f*, *h*, and *k*, are precisely such as had been used for nearly two thousand years in pumps. The vessels *d* and *e* are in fact forcing pumps, in which steam is substituted for a solid piston. The cock *b* is in the diagram open, the steam is therefore forcing the water out of *e*, and up the pipe *h*. The cock *c* is closed, and the vessel *d* is cooling; the water tends, therefore, to enter it both from the cistern *g*, *g*, and from the pipe *k*; the arrangement of the valves, exactly like those of a pump, prevents the latter and permits the former: therefore, the

vessel *d*, as it cools, is filled from the cistern *g*, *g*. This action would, no doubt, go on alternately, by maintaining the fire, and alternately opening and shutting the cocks *b*, *c*; and it is quite certain that this proposal more nearly resembles the first steam engine known to have been made, than any prior invention. In this diagram, the most unfavourable case is taken for the Marquis, because there is nothing in his description to forbid our concluding that he would have availed himself of what was then well known, the vacuum formed by the condensation of the steam. He would then have placed the vessels *d* and *e* twenty or thirty feet above the water, *g*, and in this shape it would be very nearly a perfect anticipation of the first working steam engine.

On the whole, very little credit is due to the Marquis of Worcester. The majority of his hundred projects are either absurd or puerile: some are impossible to realize, many are not worth realizing, many contain no novelty, and several have a taint of the perpetual motion. All this is so evident, that it would hardly have been thought worth while to mistranslate the Marquis, in order to make his one rational project as absurd as many of the others; yet this M. Arago does.

The Marquis says, "my vessels are strengthened by the force within them." This has been usually translated by French writers, "mes vaisseaux sont fortifiés intérieurement." M. Arago translates it, "des vases qui *se fortifient* par le *développement* de la force intérieure." He says that he is aware that the rendering of former translators is more reasonable than his own, but that it ought to be made extravagant to correspond with the other projects of the Marquis. M. Arago has certainly succeeded in making the Marquis absurd, for he supposes him to mean that the stronger the steam, that is to say, the greater the strain to which they are exposed, the stronger will be the vessels; and, in order to bear out this assumption, he alters the whole passage. Lord Worcester says, "the vessels are strengthened." M. Arago translates it, "des vases qui *se fortifient*." Lord Worcester says, "by the force within them." M. Arago translates this, "par le *développement* de la force intérieure;" the word "*développement*" is gratuitously introduced, to assist the first misrepresentation, and to help the insinuation that it was proposed to strengthen the vessels by the strength of the steam; for the word *développement* is unintelligible as applied to a constant source of strength; it must mean something which fluctuates in the vessel, and there is nothing which does this but the steam.

[TO BE CONTINUED.]

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN AUGUST, 1829.

With Remarks and Exemplifications, by the Editor.

1. For improvements in the *Preparation of Hemp and Flax for Spinning*, consisting of instruments for dressing, or sepa-

rating the hurl, in either a rotted or unrotted state, and shortening the hurl and fibre, in such a manner as to be drawn, roped, spun, and woven, the same as cotton or wool; La Fayette Tibbitts, New Amherst county, Virginia, August 1.

The specification of this patent commences with the observation that the hemp and flax dresser in general use in this country, is a French invention, patented by Messrs. Hines and Bain; which consists of several pairs of horizontal fluted rollers, so arranged that the flax, or hemp, to be broken, passes between them in succession, there being a feeding and receiving apron, and other necessary appendages.

The improvement now proposed, consists in arranging the rollers in pairs around a large spur wheel, there being pinions on the ends of the lower, or inner rollers, taking into the teeth of the spur wheel; the feeding and receiving aprons being fixed so as to suit the arrangement of the rollers.

"The part of the preparation of hemp and flax, by shortening the hurl or fibre, consists in cutting, pulling, or tearing to pieces, and separating or loosening the fibre, which is effected by a slight alteration of the ordinary cotton or wool machinery." The claim is to the particular positions of the fluted and other rollers in the brake, and the manner in which they receive their motion by a large rotary, vertical spur wheel, "and to the principle of shortening the hurl or fibre of hemp and flax, so as to be carded, drawn, roped and spun, the same as cotton or wool, without restricting myself to any particular form of instruments for effecting the same, as above mentioned."

At p. 252, there is an account of a patent obtained by Messrs. Barnum and Stevenson, for a machine for the same purpose as that of Mr. Tibbitts, in which the rollers are arranged round a large spur wheel, in a way similar to that above described; the claim to novelty, therefore, on this point, is not uncontested. The claim to the "principle of shortening the hurl, or fibre of hemp and flax, so as to be carded," &c. may serve to prove that Mr. Tibbitts is uninformed of what has been done, or rather attempted, both in England and here, in that particular. Considerable sums have been expended upon this project, and the plan has been abandoned, because it was found to be the very reverse of a "useful improvement." Should Mr. Tibbitts succeed in making yarn and cloth from chopped hemp and flax, his claim to the *principle* cannot be sustained, and we apprehend that he will not attempt the *practice*, if he takes the trouble to ascertain what has already been done in this way at Patterson, in New Jersey, and elsewhere.

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2. For a *Machine for Washing Clothes;* William E. Arnold, Hadam, Middlesex county, Connecticut, August 3.

This machine consists of an oblong trough to hold the suds and clothes, and is furnished with the means of squeezing the latter between a piece of timber, which is made to slide backwards and forwards in the middle of the trough, and two other pieces standing near to each end of it. If there is any thing new in it, the inventor

has left the discovery of it to the ingenuity of others, as there is not any claim either to the whole, or to any particular part.

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3. For *Avoiding the Dead Point in the Crank* in the Steam Engine; Valentine Carter, Washington county, District of Columbia, August 3.

This is a new and unimproved edition, of what has been many times patented, essayed, and abandoned. A double rack, formed by teeth within the two sides of an oblong frame, and a pinion with which the racks are alternately to engage and disengage, constitute the *invention*. The claim is to the combination of the whole. A cent for each impression made from engravings of similar contrivances, would be a sufficient fortune for any one whom a lack of roupees would content; and if to this was added the amount which has been expended and lost in attempts to carry the plan into execution, a very comfortable addition would be made to the capital.

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4. For a *Thrashing Machine;* Enoch A. Harman, Upper Marketfield, Bucks county, Pennsylvania, August 5.

"This improvement consists of a vibrating breast, or pitch, formed on, or near, a quarter circle, to be supported by one or more springs on each side, either of wood, or steel, above or beneath the breast, or pitch, or by pullies, or weights."

We have copied *the whole* of the description of the above named machine, and it will be seen that it is without any claim, which happily avoids what appears to us to be a very great difficulty, namely, the discovery of any novelty about it. There is a cylinder, with beaters, a hollow segment of a circle, borne up by springs, and between which and the beaters the grain is to pass; there are also feeding rollers, and a feeding apron, such as are to be found attached to the greater number of its predecessors, many of which ornament the model room of the patent office.

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5. For a machine for the purpose of *Ditching, and Excavating Ground for Canals*, or other purposes; George Henricks, Urbanna, Champaign county, Ohio, August 5.

(See specification.)

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6. For a *Cooking Stove,* called the Double Furnace Cooking Stove; Josiah Richards, Claremont, Sullivan county, New Hampshire, August 5.

This stove is to be made in part of sheet, and in part of wrought iron. In some points it bears a resemblance to A. and J. Barnett's cooking stove, noticed p. 174; the oven, as in that, is below the fire, and the heated air is made to pass under the oven, in its passage to the chimney. There is a contrivance for lessening the furnace part,

by the closing up of two cast-iron plates, and it is from this part, we presume, that it receives the name of "Double Furnace."

There is no claim, either general or particular, and we do not know, therefore, what part is viewed as new by the patentee.

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7. For a *Machine for Breaking Flax, Hemp, and every kind of Textile Plant*, rotted, or unrotted; J. L. F. Roumage, New York, August 6.

We have here another machine for breaking flax, &c. in which the fluted rollers surround, in part, the circumference of a large cog wheel, which causes them to revolve by the gearing of its teeth into the leaves of their pinions; resembling, in this particular, that described by Mr. Tibbitts, (No. 1,) and that of Barnum and Stevenson, p. 252.

A large iron cog wheel, 6 feet in diameter, and having 256 teeth, is made to run vertically, its axis being supported by a strong frame of timber. Two semicircular segments of cast-iron are fastened to the wooden frame; these segments receive 38 pair of fluted rollers, one pair of which are of cast-iron, and the others of hard wood. The gudgeons of these rollers run in boxes, fixed in slots, cast in the segments. The lower roller of each pair has a pinion of 11 leaves on one of its gudgeons, to gear into the large cog wheel. The outer roller of each pair is driven by the motion of the inner. The segments are, of course, of such a size as to admit the cog wheel to stand within one of them, so that it may drive all the pinions. The upper roller of each pair is pressed down upon the lower roller, by means of a steel spring in the form of the letter C; one end of the spring resting upon the box of the upper roller, and the other against the end of the slot in which the box is contained. The larger wheel may be driven in any convenient way. It is proposed to use feeding and receiving aprons, although, it is observed, the feeding and receiving may be done by hand.

There is no claim to any part of the machine.

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8. For an improvement in the mode of *Stiffening Hats;* Jonathan D. Wilson, New York, August 6.

The rim of a hat, and the top of the crown, are to be stiffened in the usual way, whilst the part between is to be left without stiffening of any kind. A piece of buckram, or other stiff substance, is made to fit within the hat, the lower edge tucking under the sweat leather, and the other extending up to the crown. When this is removed, the hat may be flattened down, and put into a trunk, and when replaced, the hat will resume its usual appearance.

The inside stiffener constitutes the claim.

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9. For an improvement in the *Use and Application of Steam;* Timothy Packard and John E. Strong, Granville, Washington county, New York, August 7.

The end proposed, and the novelty claimed by the patentees, is, "the application of steam for the purpose of heating water in tubs, or vessels, for the purposes for which hatters, in their trade and business, usually heat water in boilers and kettles with fire applied under or around them." "By which *invention*, or *discovery*, any number of vessels may be heated in wood, instead of metal vessels, and by one fire for the whole, instead of one fire for each kettle, or vessel," &c. &c.

It is now more than forty years since the first introduction of this mode of heating coppers and vats for dyers, and other purposes; during which period it has been, and still is, very extensively practised: it was, long ago, applied to hatters' kettles in Philadelphia, and probably in other places.

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10. For an improvement in *Book-binding;* Jesse Torry, Germantown, Philadelphia county, Pennsylvania, August 8.

The book is to be sewed to cords or bands, in the usual manner, with the omission of kettle stitches; the bands are not to be inserted in a sawed groove. The book, after being partially sewed, is to be placed in a press, and a strip of leather, from three to five inches in length, glued across the back near to each end, so as just to escape the trimming. A piece of cloth is then to be glued upon the back, sufficiently wide to lap an inch or two upon the lids. When dry, the book is to be trimmed, and again sewed by passing the needle through each signature, near each end, and drawing the thread round the cloth and strip of leather, and over the ends of the leaves, so as to secure them firmly.

The boards are to be protected at the corners and edges by strips of tinned iron, soldered at the corners, and placed either above or under the leather. The leather over the back is left loose, so as to open from the back of the cloth. The binding is to be defended from the attacks of insects, by the mixing of a decoction of tobacco and red cedar, with alum, in the paste.

The claim is to the method of gluing cloth and calf skin upon the back; to the sewing the leaves afterwards to them, so that the thread is passed round on the ends of each leaf; to the attaching the cloth and strips, so glued, to the boards; to the securing the boards by strips of tinned iron; and to the materials mixed with the paste, to protect the binding from insects.

We are not sure that tinned iron has been employed for the purpose proposed; but who has not seen the Bibles, Missals, and other books bound in Germany, double fortified with brass, and sometimes with silver? But, as the present claim is to tin only, brass and silver, we are to conclude, will not interfere. Alum is commonly put into paste, and different materials have been added as a protection against insects; we do not know that the two, above named, have ever been employed, nor are we certain that they are the best which can be found.

11. For improvement in the shears of a *Cloth Shearing Machine;* Samuel A. Britt, Cazenovia, Madison county, New York, August 10th.

A cylinder, three or more feet in length, and about three inches in diameter, is surrounded by four blades of steel, which are bent so as to make a quarter of a circle round the cylinder. These blades, or cutters, are each sustained upon springs. The cutters in their revolution pass, and act against, a stationary blade or cutter, performing the operation like ordinary shears.

There is not any thing claimed in this invention, and the whole so strongly resembles several other patented machines, as to leave us at a fault in the attempt to discover where the improvement lies. The drawing is without references.

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12. For a *Cooking Furnace Gridiron;* Jonathan Powers, Lansingburg, Rensselaer county, New York, August 10.

The following is the specification:—

"The Gridiron is in a circular form, and concavo-convex; the ribs or bars of which, on the upper side, have a concave upper surface for collecting the gravy, and conveying it downwards to the gravy trough, which stands all around, on the outer edge, having its spout on one side for discharging the gravy. There is a handle on one side."

"It may be made of cast-iron, or wrought, or sheet-iron, or any other material, and may be varied in form, size, or shape, as convenience may require, with, or without legs, for so I make them.

"Jonathan Powers."

We are again at a loss to know what is intended to be patented. It certainly cannot be a round gridiron, as these have been made by the thousand. The fluted, or concave bars, and gravy trough, we have known for upwards of forty years: these, therefore, are not new. But, as the patentee has not chosen to tell his claim, it is not our business to do so; we therefore leave the discovery to others.

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13. For *Preserving Apples and other fruit,* Beets, and Sweet Potatoes, and other roots; Amos Hart, Wharton, Fayette county, Pennsylvania, August 10.

The mode proposed is to pack the fruit, or roots, in dry pulverized charcoal, contained in well seasoned wooden vessels.

The use of charcoal in preserving animal matter, and in destroying the putrescent odour and taste of the most filthy water, is well known, and we have no doubt that the same article will tend to preserve vegetables from decay. We apprehend, however, that the soiling effect of fine charcoal dust, will prevent its extensive use, excepting, it may be, in packing fruits, &c. for exportation.

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14. For a Compound *Lever Press for Pressing Cotton;* Philenzo Payne, Claiborne county, Mississippi, August 10.

We will hereafter give an engraving of this press, with a description, or specification.

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15. For *Raising the Nap on Woollen Cloth;* Zachariah Allen, Providence, Rhode Island, August 10.

The improvements in the machinery for raising the nap upon cloth, consist, first, of what is, by the patentee, denominated combs, two of which are made to act, with reversed movements; one being placed at each end of a roller over which the cloth passes, preparatory to its being operated upon by the teasles, or cards. The intention of the combs, and of two rods attached to them, is, to draw the cloth, widthwise, thereby removing all wrinkles, or folds, which would prevent its being acted upon equally in every part; secondly, in a contrivance for laying the cloth in regular folds, after it has passed the teasles, in order that it may be ready for the same operation, and rise free and disentangled, for this purpose. These are the two points claimed. The exact mode pursued would require drawings for its explanation.

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16. For a machine for scattering manure, called a *Manuring Wagon;* James Bowman, Beaufort, South Carolina, August 12. See page 277.

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17. For a *Machine for Spinning Wool,* for the use of families and manufacturing establishments; Warren Allen, New Haven, Oswego county, New York, August 15.

The description of this machine, is of considerable length, but appears to us to be laboured and involved, whilst the drawings which accompany it, lend but little aid in understanding its construction. The machine, like most of the *family spinners,* seems to possess but little novelty; there are many such instruments, but they are generally only epitomes of those of a larger kind.

There is no claim whatever, and, of course, the whole machine must be new, or the patent of no value.

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18. For an instrument for *Sharpening Knives,* and other cutting instruments made of iron, or steel, called "Dunn's knife-sharpener;" William J. Dunn, New York, August 18.

This, in its mode of operation, is very similar to some instruments for a like purpose, which we have already described; (see p. 398, of the last vol.) Two steel plates are prepared by having teeth cut into them similar to saw teeth: they, however, differ from saw teeth in being varied in size, the angle at the bottom being made more acute, as you proceed from one end towards the other. The two plates are notched alike, and are to be placed upon each other, and retained in their situations by a screw, or screws. The plates may be about two inches in length, and when fixed in a handle, or stand, for use, the teeth of the two are not allowed exactly to coincide, the

plates being slid a little, endwise, the angle at the bottom of each notch is then formed by the two plates conjointly; and by altering the lapping, a new sharpening angle is obtained. The claim is for "forming the teeth of two, or more sizes and widths, so as to adapt it to the sharpening of knives, and other instruments of different sizes, more effectually; and with two, or more, steel plates."

The same end has been attained in one of the English instruments above alluded to, and also in some made in this country. The defect of instruments of this kind, where but two plates are used, is, that the knife, in being sharpened, has its hollows, or indentations, rather increased than corrected, whilst the number of bearings employed in Westby's, and other sharpeners, straightens, as well as sharpens the edge. The mode of altering the angle in the sharpeners may be seen in the wood cut of Westby's.

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19. For an improvement in the business of *Ferrying and Draying;* Lunenberg C. Abernathy, Boone county, Kentucky, August 18.

A paddle wheel, like that of a steam boat, is to be placed on one side of a river, and is to be driven by the current. The shaft of this wheel carries two cog wheels, which may alternately be made to engage in a wallower, and turn it in opposite directions. On the same shaft with the wallower there are two drums, to each of which, one end of a rope is to be fastened, and around each a portion of it is to be coiled; this rope is also to extend, double, across the river, and pass round a pulley on its bank. To the middle of this rope the ferry-boat is to be attached, when it may be sent over, and returned by a man who attends the wheel, and engages and disengages the wallower.

The same apparatus is to be attached to a dray, or other carriage, to draw goods from or to a warehouse, near the banks of the river. The whole plan, we suppose, being considered as new, no particular claim is made.

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20. For an improvement in the *mode of Cutting Garments;* Otis Madison, Troy, New York, August 18.

A flat ruler, something like a Gunter's scale, is to be divided in a way designated in the specification and drawing, furnished by the patentee. The measurements taken are to be marked down upon a piece of slate, or slate paper, let into, or otherwise attached to the 'Mathematical Ruler.'

The claim is to the mode of arranging the divisions, or measures, and the attaching the slate, or slate paper, to the ruler.

It is acknowledged by all the amateurs in the art of Cutting Garments, that the scales, which within a few years have come into general use, have introduced a degree of system and certainty into that business which were previously unknown. There are a number of patented instruments, invented by different professors of the art; we are compelled, however, to tread lightly upon the ground which

they have occupied, or we should soon manifest our want of skill; our learning not enabling us to explore it with advantage to others, or safety to ourselves.

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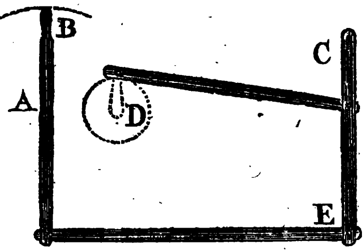
21. For a *Portable Trip Hammer;* Samuel Kilburn, Sterling, Worcester county, Massachusetts, August 18.

A fly wheel is to be turned by a crank, having upon the axis a cam wheel, with five teeth, or lifts, which are to operate upon the handle of the hammer. This machine is intended to be turned by hand, the hammer to weigh from 20 to 50 lb. and the fly wheel from 150 to 250. The part in which the merit of the machine is supposed to consist, is a combination of levers for giving motion to the crank, instead of turning it directly by hand. There are four of these levers, the first of which is moved backward and forward by hand, whilst the last of the series acts as a pitman, one end of it being attached to the crank. The claim of the patentee is to this combination of the levers, which he thinks will produce a great mechanical advantage. The sketch in the margin will serve to show the arrangement proposed. The first lever works on a fulcrum at A, being acted upon by the handle at B; the third lever has its fulcrum at C, the fourth, or pitman, being attached to the crank D.



As to any mechanical advantage to be obtained by a combination of levers, where time and power are both taken into the account, it is a nullity. We, at one time, thought that the vibrating motion of B, might be less fatiguing than the turning of the common crank, and many years ago fixed a lever to turn the large wheel of a lathe upon this principle. Suppose the lever C, E, in the above sketch, to turn upon a fulcrum at E, the handle being at C, with the pitman and crank D, just as shown above, and our whole arrangement will be understood. It was kept in use for a considerable length of time, and those who worked it were undetermined in their opinions as respected its advantage over the crank. We mention this, because we think that the only possible benefit of Mr. Kilburn's levers, must be afforded by the application of the power of a man in a better manner than that usually followed; but even this, according to our experience, is doubtful.

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22. For an improvement in the making or manufacturing of *Blanks for Checks, or Drafts,* or Bills of Exchange; James Atwater, New Haven, Connecticut, August 18.

On the 11th of June last, a patent was granted to James Atwater, Nathaniel Jocelyn, and Simeon S. Jocelyn, for the purpose indicated in the title of the present patent. An improvement upon that plan has been made by Mr. Atwater, and for this improvement a patent

has issued. The interest of the patentee forbids the publication of his specification, at present.

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23. For an improvement in the *Wheat Fan*; George Heffman, Frederick county, Maryland, August 21.

The general form of this fan is the same as those in common use, but it differs in a variety of particulars, which it would be difficult, if not impracticable, to explain without a drawing. The mode of communicating motion to some of the parts, the wind-wheel and the riddles, offer certain peculiarities, which are described and claimed by the patentee.

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24. For preparing or *Manufacturing Dye by Steam*; Reuben Wood, Erin, Tioga county, New York, August 25.

We have, in our remarks on the patent of Messrs. Packard and Strong, (No. 9,) anticipated all which it might be necessary to say upon the subject of the present patent, as the plans are essentially the same. The claim is to "the application of steam to the making, preparing, and manufacturing of dyes."

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25. For an *Air Furnace Oven Stove*; Oliver Davison, Johnstown, Montgomery county, New York, August 25.

We cannot perceive in this stove any thing materially different from a number of others, although it varies from them in the form of some of its parts. The patentee has merely described the whole, without making any claim, or telling in what his invention consists, and as we are unable to do so for him, we dismiss it without further remark.

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26. For a machine for *Packing Cotton*; Obadiah Stith, Laurenceville, Brunswick county, Virginia, August 25.

Each cheek of this press consists of two bars of iron standing upright. They are framed into a bed piece, and stand at the distance of a few inches apart, to allow a piece, called a driver, to extend out between them. These iron bars are perforated with round holes, to receive pins which serve as fulcra, upon which the levers work which are to force the driver and follower down upon the cotton. The cheeks are placed apart at a distance equal to the length of the bale to be packed. The levers, of which there are two, are each twenty feet long; they have a mortise in the middle, to allow them to pass up and down on the iron cheeks at each end of the press. The levers are to be drawn down at each end, alternately, the pins placed in the holes of the bars being shifted as they descend. The sides of the press are boxed up to receive the cotton, which is put in at the top. When the levers are at the upper end of the cheeks, the driver falls on one side, and offers no obstruction to the introduction of the cotton. An iron strap, or stirrup, from each end of the driver, con-

nects it with the levers, descending into the centre of the mortises, where it is secured by strong pins, upon which it works as a joint.

We shall probably recur again to this press, as it is certainly more simple than many of those which are used for the same purpose, and we think that it will be found convenient in practice; should this appear to be the fact, an engraving shall, hereafter, be given, for the purpose of making it better known.

The general construction of the press is claimed, as is the particular mode in which the levers are made to operate; the iron cheeks with the slot between the bars which compose them, and which allow the driver to be drawn down by the levers; the application of the stirrup and driver, are also claimed.

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27. For a machine for *Raising Water by Atmospheric Pressure;* Samuel M'Cune, Wilmington, Clinton county, Ohio, August 25.

Captain Savary's engine, was, in its day, a thing of great merit, but its reinvention will scarcely confer immortality upon any one of the numerous candidates for that honour. The present patentee appears sensible, however, that there is nothing new in the principle of the engine which he has patented, as he says "it is expressly to be understood, that what I claim as new, is, the mechanical application of the above." We must not, therefore, place him in the class of those who have simplified the steam engine, by restoring it to the state in which it existed a hundred and thirty years ago, as he merely proposes to open and close his valves, introduce his jets, and perform some other requisite operations, by an arrangement of parts somewhat different from that formerly pursued. There are to be two cisterns, which are alternately to be filled with steam, in order to its being condensed by jets of cold water; they are then to be filled with water by the pressure of the atmosphere upon that contained in a reservoir below, into which pipes, furnished with valves, pass from the receivers, or cisterns. The water is to be let out from these upon a water wheel, and from the shaft of this wheel the motion is derived which is necessary to the introducing the condensing water, to the opening and closing of the valves, and for other purposes. We do not think it necessary to describe the manner of doing these things, as there does not appear to us to be any particular merit in them. And when it is recollected that the cylinder and piston engine has long since superseded the use of captain Savary's, even where the only operation to be performed is the raising of water, no one versed in the history of mechanical inventions would believe that it was any great improvement to use the latter in turning a mill.

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28. For an improvement in *Canal Boats;* Thomas W. Bakewell, Cincinnati, Ohio, August 25.

The object proposed to be accomplished in the improved canal boat, is, to fix an awning above the roof, or top, of the cabin, which awning may be lowered to admit of passing under a bridge. A

patent for a contrivance for the same purpose was granted to Jacob Bromwell, of Cincinnati, on the 23d of June last, and is noticed at p. 190. The support of the roof, or awning, as described by the present patentee, is to be constructed of light pieces of timber, so framed and jointed, that they may double down upon the permanent roof, upon the principle which regulates the approach of the two sides of a parallel ruler, as will be seen by the claim, which is "the application to canal boats of the forementioned principle, which principle is that on which the parallel ruler is made, and by which a rectangled parallelogram may become a rhomboid, and vice versa, the sides remaining unchanged."

It is proposed, as in Bromwell's patent, to render the awning self-acting, by a projecting piece, properly fixed, to strike against the bridge, and press the framing down; it may also be made to rise spontaneously by a weight acting over a pulley, or by other means.

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29. For an improvement in the *Grist Mill;* Job Wickersham and Thomas Crozier, Fairfield, Columbiana county, Ohio, August 25.

This is another contribution to the number of grist mills which have been proposed for family use. It possesses, and, in fact, lays claim to, but little novelty. The lower stone is to be the runner, and is to be 16 inches in diameter. The upper, or stationary stone, is square, and measures 18 inches on the side; it is perforated to allow of feeding. The runner is fixed permanently on the spindle. The claim is to "the runner being permanent on the spindle, and the arrangement of the boxing, by which we are enabled to make it tight below, and prevent all waste of meal."

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30. For manufacturing *Felt for Cloth, Padding, Carpets, &c.;* John Barker, Bridgwater, Oneida county, and Leonard Kinsley, Catskill, New York, August 25.

The machinery to be used, and the manner of procedure, are similar to what has been already described in several preceding patents, having the same object.

There is to be a carding machine, to deliver the wool in a continued sheet.

A long table, or frame, with an endless apron, on rollers.

A portion of the web, or batt, is to be cut, or torn, and placed crosswise upon the apron, and the operation continued until the wool is sufficiently thick for felting.

"What we claim as our invention, of the above described machine, is, the construction and application of all, except the carding machine."

Specifications of American Patents.

Specification of a patent for some improvements in the boilers of Steam Engines. Granted to Anthony Hermange, *Baltimore, Maryland, November 26th,* 1828.

To give a sufficient description of my improvements in steam boilers, it will not be necessary to enter into an account of steam boilers now in use; as they are, of course, very various, and well enough known, to distinguish them from my modes of construction. The boiler itself, with regard to its outward contour, I will make of any convenient shape. As convenient a one as any, will be to have it of a cylindrical form, or of that of a parallelopiped; or this last surmounted by a half cylinder; or of a prism, whose base is a hexagon; of a cubical, or indeed of a variety of forms. I will place the fire-place, and flue, and fuel-pipe, (where I have one especially for that purpose, particularly when the fuel to be used is coal) inside of the boiler, disposing of them in such a manner, that when the proper quantity of water shall be in the boiler, they shall be below its surface. This will secure the advantage of having the water almost entirely to surround the fire-place, flue and fuel-pipe, where this last is employed. The flue, particularly, shall be lengthened out inside of the boiler, in a variety of ways, in order that it should present an extensive surface in contact with the water, and that the heat evolved in the fire-place, should thus, by means of the heated air freely circulating through the lengthened flue, be all, or nearly all, communicated to the water before the flue passes out of the boiler. The flue will, in this manner, have an effect somewhat analogous to that of a reverberatory furnace. I said the flue may be lengthened out in a variety of ways; it may, for example, go from the fire-place perpendicularly upwards for some way, then form an arch, and return vertically downwards, and have its exit from a convenient place in the lower part of the boiler, or thereabouts; this would be one of the simplest methods. After ascending as before, the flue may have a tortuous, or spiral, disposition downwards, and have also its exit as before.—The main flue may also, above, be divided into two, three, four, or more, smaller flues, as convenience may dictate, and these again may be connected together in the bottom part of the boiler, or towards the bottom, for their exit from the boiler, by a single flue or more; from the fire-place, the flue may have a serpentine form in the boiler, and have its exit at any convenient place. In fact, it will readily be perceived that a variety of modes may be adopted. The fire-place I will construct of any convenient form, and place it in any position that the easy introduction of fuel, or any other such circumstance, shall require. It may, for instance, be placed at the bottom of the boiler, with a grate opening into a wind-box below the boiler; in this way, the fuel-pipe may communicate from the side of the boiler, at an angle from the horizon, sufficiently inclined to permit the fuel to fall with facility into the fire-place. This would be an excellent disposition, when the fuel to be used is coal; a coal-receiver, with two

sliders, or doors, may thus be adapted to the outside end of the fuel-pipe, in order that, at the instant of supplying fuel to the fire, the heated air in the fuel-pipe may not be suffered to escape. When the fuel is to consist of wood, it would, no doubt, be better to have the fire-place opening, for the reception of the wood, on the side of the boiler, or the end of it, by means of a door a little above the bottom of it; so that the water may also come in contact with the bottom of the fire-place. In this way, also, there may be practised, if convenience requires it, an opening through the bottom of the fire-place, (across which, a grate may be placed, through which the ashes may drop) communicating with an opening through the bottom of the boiler, which may there have a wind, or blast, box, attached to it. It will be perceived that the arrangement may be various. As in the combustion of the fuel, with regard to boilers in common use, much of its inflammable substance passes off in the form of dense smoke, &c. without entering into a perfect state of combustion, I will employ bellows (conveniently adapted for the purpose, and which may, of course, be worked by the engine itself) for the purpose of keeping up a constant current of atmospheric air through the ignited fuel, and to keep up the current of air, thus heated, throughout the course of the flue. As the air, in approaching towards the exit of the flue, from the boiler, will become cooler, and, of course, from its increased density be of less volume, it will be well, ordinarily, to diminish the flue, gradually, as it approaches its exit. I will avoid bringing the fuel-pipe (where one is used,) or the flue, into that part of the boiler occupied by steam, for the following reason: the fuel-pipe and flue, having a direct communication with the fire-place, would, of course, always be filled with air intensely heated, which would be extremely likely to keep them in a red hot state; in this condition, being in contact with steam, a constant decomposition of portions of the steam would take place; its oxygen combining with the metal, would rapidly corrode it, to the evident danger, after a little use, of the bursting of the boiler; whilst hydrogen gas would be extricated, during the progress of decomposition, which might interrupt the free and secure motion of the rest of the machinery of the engine. For the purpose of ascertaining, always, the height of the water in the boiler, I will make use of any description of water-gauge that may be adapted to ordinary steam-boilers: a very good one will be to have two short pipes accurately inserted into the boiler; one, into that part occupied by the water, and the other into that containing the steam; and the communication with both formed on the outside of the boiler, by means of a strong glass tube; in this way, the height of water may always be determined by sight. A stop-cock may be used; but will not, of course, be so convenient as the water-gauge above. It would be well to have the steam-pipe going off from, or near, the most elevated part of the boiler; this will be a matter of convenience. For supplying the boiler with water, I will make use of any of the ordinary means. The pump for the supply of water may be so managed as to have, at will, a longer or shorter stroke, according to the demand of the boiler for water. In the construction

of these improvements, I will employ any description of metal in common use for steam-boilers; but I need not add, that copper would be the best. The blast-box, where one is used, will, of course, vary in its structure, according to the most suitable adaptation to the boiler, as well as the bellows employed. The wind-pipe of the bellows may either be adapted to a blast-box, or may be moveable, so as to pass through a hole made in the door of the fire-place, (where there is a door) or permanently fixed under the door, or at its side, or indeed in any other convenient situation. As for the fastenings, or other modes of adapting the several parts of the boiler, &c. together, I need hardly mention that I will adopt any convenient modes now in common practice in similar cases.

After the exit of the flue from the boiler, it may, if thought proper, be carried through the water tank, or vessel, destined to keep up the supply for the boiler, for the purpose of heating it before it is pumped into the boiler. No doubt, most of the principles laid down in the preceding descriptions, have, taken separately, been heretofore known; but I claim as my own, the combinations of principles therein stated. Anthony Hermange.

Description of the Drawings—Plate 4.

Fig. 1, is a vertical section, showing the internal structure of the boiler, &c. The fuel fitted for a boiler made in this way would be coal.

a, the fire-place.

b, the grate.

c, the blast-box, with a slide, or door, at the bottom.

d, the wind-pipe of the bellows.

e, the fuel-pipe.

f, a sliding door, shutting the fuel-pipe, and when opened, permitting fuel to drop down from the fuel-receiver.

g, another sliding door, stopping the communication from the open air, when the slide *f*, is open.

h, the fuel-receiver, or box.

i, *i*, *i*, space of the boiler occupied by the water.

k, space of the boiler filled with steam.

l, steam-pipe.

m, water-gauge.

n, *n*, *n*, flue-pipes: there may be four, more or less, passing down through the bottom of the boiler, and ending in a single larger flue-pipe.

Fig. 2, represents the bottom of the boiler, pierced by the flue-pipes *n*, *n*, &c.—*b* is the grate at the bottom of the fire-place.

n', is a larger flue, forming the exit from a flue, or heat-box, below the boiler; *n*, *n*, open into this flue-box, after having pierced through the bottom of the boiler.

Fig. 3, represents *n*, *n*, passing into flue-pipes, instead of passing from the boiler into a flue-box below. These flue-pipes *p*, *p*, communicate with *n'*; they might, if convenient, be placed under the boiler.

Fig. 4, is a middle section of a boiler in the form of a parallelopiped, surmounted by a half cylinder. This is an excellent mode when the fuel is wood. When similar letters to those in Fig. 1, are used, they represent portions of the boiler, &c., intended for similar purposes. The dotted additions to the figure (*b*, *c*, *d*,) show how a grate, wind-box, and the wind-pipe of the bellows may be adopted.

o, is the door of the fire-place.

Specification of a patent for a machine for Ditching, or Excavating Ground for Canals, or other purposes. Granted to George Henricks, *Urbanna, Champaign county, Ohio, August* 5, 1829.

I make a carriage, or frame, with four wheels, the front wheels being made and fixed in all respects like those of a common wagon. Under the body of the carriage, a plough, with the mould board, of any of the known forms, is fixed so as to extend along between the hind and fore wheels, the land-side of the plough standing in a line with the centre of the bed of the carriage, or frame, so that the mould board may reach nearly to one side; it is also to be depressed sufficiently below the wheels to turn up the required quantity of earth. In order to remove the earth as it is turned up by the plough, there are a number of elevators, or boxes, made usually of strong sheet iron, somewhat in the manner of the elevators of a flour mill, but much larger. These elevators are attached to each other, so as to form an endless band, or chain, the boxes being connected to each other by means of strong links. These elevators are made to revolve by passing them round two revolving shafts, or rollers, one of which is fixed as near to the mould board of the plough, as will allow the elevators to pass round: this stands longitudinally with the carriage and plough. The other roller is fixed by proper frame work above, and extending to a distance beyond the side of the carriage. When this chain of elevators is made to revolve as the carriage is drawn forward by horses, or oxen, the earth which is ploughed up is received into the elevators, is by them raised and carried beyond the side of the ditch, so as to be delivered, or thrown upon the bank, or it may be thrown into carts, or on to stageing, in the digging of canals.

In order to cause the shafts to revolve, upon which the excavators are sustained, the lower of these shafts is geared to one of the hind wheels, from which teeth, or cogs, project inwards, so as to take into teeth, or cogs, which form a trundle upon the end of the shaft; the planes of these wheels, or trundles, standing at right angles with each other. The shaft I generally make square, so that the flat sides of the elevators may exactly fit them on each face, as they revolve. If made round, spikes must project from them in such a way as to check the elevators, and prevent their slipping round.

In order to insure the turning of that wheel of the carriage to which the shaft is geared, its periphery, or rim, has a number of projecting

spikes of iron, to lay hold of the ground; as, without these, it would slide, instead of turning.

What I claim as new in the above described machine, is, the use of the elevators, plough, rollers, and gearing, in the manner described. And I do hereby declare that the foregoing is a full and clear description of my said machine.

GEORGE HENRICKS.

FRANKLIN INSTITUTE.

Quarterly Meeting.

THE twenty-third Quarterly Meeting of the Franklin Institute, was held at their Hall, October 15, 1829.

ISAIAH LUKENS, Vice President, in the Chair.

The minutes of the last Quarterly Meeting were read and approved.

The annexed quarterly report of the Board of Managers, accompanied by the quarterly report of the Treasurer, was presented and read; when, on motion, it was accepted, and referred to the committee on Publications.

On motion, adjourned.

ISAIAH LUKENS, *Vice President.*

A. S. ROBERTS, *Recording Secretary.*

The twenty-third Quarterly Report of the Managers of the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts.

THE Board of Managers, in obedience to the 3d section of the 10th article of the constitution, make report of their proceedings since the last quarterly meeting of the Institute.

The principal objects which have engaged the attention of the board during the preceding quarter, are the experiments "to ascertain the value of water as a moving power, and the relative effects produced by it on water-wheels of different constructions," and the monthly meetings for the discussion of scientific questions, upon the plan adopted at the quarterly meeting in April last.

The committee appointed to carry into effect the views of the board on the subject of water power, have continued to be actively engaged in the prosecution of the undertaking, and by their zealous and praiseworthy perseverance, have succeeded in collecting about $2,000 to defray the expenses.

The house for the accommodation of the apparatus for making the experiments, situated at the corner of Ninth and Vine streets, is completed. Four mill-wrights are now at work; and it is confidently expected that the committee will be able to present to the Institute the result of their labours at the next annual meeting. An additional subscription is considered necessary to enable the committee to complete the experiments, which, it it is hoped, the members of the Institute will voluntarily contribute to an object of so much utility.

The monthly meetings have been regularly held, and the subjects proposed have been discussed in that liberal and amicable spirit which ought always to characterize the search after truth. It is believed that something has already been done to forward the great work of improvement, for the promotion of which this association was formed.

A more general attendance of the members is desirable, and would tend to increase the interest already excited at these meetings, and render them still more useful.

The Committee on Inventions have diligently attended to the objects submitted to their inspection, which have been more numerous than formerly. The utility of this Committee is beginning to be generally felt and acknowledged by inventors, and they are frequently put in possession of facts and principles in relation to their supposed inventions, of which they were previously ignorant, and by which their views and pursuits are entirely changed. Thus, often an honest and industrious mechanic, with mistaken ideas, is saved from the loss of time and money, while the ingenious inventor is encouraged and assisted by the countenance and concurrent opinions of those more experienced than himself, and thereby enabled to reap the reward of his exertions, at the same time that an important improvement is ultimately secured to the public.

The Board of Managers also beg leave to announce that the vacancy in the Professorship of Mechanics and Natural Philosophy, occasioned by the resignation of Dr. T. P. Jones, has been filled by the election to that office of Walter R. Johnson, A. M.

The lectures for the season, will commence on the second Monday in November, and it is hoped that the members of the Institute will evince by their attendance, that interest in them which the variety and the utility of the subjects to be treated of would seem naturally to excite.

The Board have always viewed the lectures of the Institute, as one of its most useful auxiliaries in the diffusion of practical and scientific instruction through the community, and also as one of the most effectual means of increasing the prosperity of the institution, and, therefore, respectfully ask the members of the Institute to aid and assist by their exertions, in extending the sphere of their usefulness.

The Board announce, also, that Mr. S. C. Walker has resigned the office of Teacher of the Mathematical School of the Institute, which he has conducted in a creditable and satisfactory manner.— The vacancy thus created, has been filled by the appointment of Levi Fletcher, A. M., a gentleman already known to the Institute as their first teacher of Mathematics, from which situation he was compelled to withdraw, in consequence of ill health.

From the additional experience Mr. F. has acquired in the practical applications of the science of Mathematics, by being employed several years on board one of our ships of war, the board feel every confidence in his ability to communicate instruction in that department. The school will be opened the 27th inst.

The Drawing School will be opened at the same time, under the direction of the former teachers, Mr. H. Bridport and Mr. G. Strickland. The Board recommend strongly to the members these evening schools, as of very great importance to the rising generation, connected as they are with the privilege of attendance on the lectures. An opportunity is thus offered of acquiring useful knowledge, at a much cheaper rate than it can be obtained in any other manner, and at the same time of keeping the youths who attend, away from the haunts of idleness, immorality, and vice, and nourishing in them, at an early period of life, a taste for the solid pleasures which the study of the arts and sciences must always afford.

The quarterly report of the treasurer is herewith presented, from which it will be discovered that the general funds of the Institute are very limited, owing to the tardiness of many of the members in the payment of their dues. The Board take this opportunity of urging punctuality, as the only means by which this association can be rendered beneficial to its members and the public. The funds appropriated to meet the current expenses are at present considerably deficient of the amount due by the Institute, and as the expenditures have been limited by the Board to the least possible sum, to keep them within the receipts, they have been compelled to postpone the execution of several important designs for want of means. If each individual member would use a moderate exertion for the interest of the society, it would be enabled not only to liquidate every debt, but would also have ample means to carry all the views of the Board into effect.

The sinking fund derives from the rents of the building, and from other sources, an income sufficient to pay the interest on the Loan, and leave an annual surplus, which will in a few years reduce the debt to a very moderate sum.

A number of valuable additions were made to the Library and Cabinet of Models and Minerals during the last quarter. The board are happy in being able to state that the Hall of the Institute is becoming more and more attractive to the public. The number of models of machines recently deposited, and the valuable collections of minerals, books, and periodicals, now belonging to the Institute, are very interesting to strangers, as well as citizens. The rooms are open every day, Sunday excepted, and may be resorted to with profit and satisfaction, the Actuary being constantly in attendance, using every exertion in his power to gratify the curiosity of visiters. Respectfully submitted.

Thomas Fletcher, *Chairman, P. T.*

Wm. Hamilton, *Actuary.*

Hall of the Franklin Institute, Oct. 15, 1829.

Monthly Meetings.

The Stated Monthly Meeting of the Institute was held at their Hall, on Thursday evening, October 22nd.

Thomas Fletcher, Vice President, in the chair.

The minutes of the last monthly meeting were read and approved.

The following donations were presented to the Institute, viz:—The Architecture of André Palladio, containing the antiquities of Rome, accompanied with notes and remarks, by Inigo Jones; and Addresses, by John D. Godman, M. D.; both presented by J. K. Mitchell, M. D. Gallaway's History of Steam Engines, from their origin to the present time; presented by Professor Franklin Bache. Remarks on the Legal Provisions for Education in Pennsylvania, by W. R. Johnson, A. M.; and an Introduction to the Greek Language, with a Key; by the same; both presented by the author. Judge Story's Inaugural Address; presented by Hilliard, Gray & Co. A specimen of native Gold, from North Carolina; a specimen of native Silver, from Mexico; and a specimen of Emerald; presented by Thomas Fletcher. A Galvanic Apparatus; presented by Robert T. Knight.

The Corresponding Secretary also laid on the table the following Mechanical and Scientific Journals, received in exchange for the Journal of the Institute:—*London Journal of Arts and Sciences* for September; *London Register of Arts and Journal of Patent Inventions* for September; *Gill's Technological and Microscopic Repository* for September; *Annales de Chimie et de Physique* for May and June; *Bulletin de la Société D'Encouragement pour L'Industrie Nationale* for May and June; *Journal des Connoissance Usuelles et Pratiques* for July; *Bibliothéque Physico-economique* for July; *Journal Universal des Sciences Medicale* for June.

The discussions for the evening being called for, the following papers were presented, viz. a reply to the query, "what is the relation between rolling and dragging friction?" by W. R. Johnson. A reply to the query, "which will move down an inclined plane with the greatest velocity, a wheel of two, or one of four feet in diameter, supposing their weight to be the same, and the matters of each to be all disposed around its periphery?" by Mr. Lloyd Mifflin, and another on the same subject, by Mr. Charles Potts. Mr. Potts also presented a paper in reply to the query, "what is the absolute centrifugal force of a body revolving in a circle of a given diameter, *d*, with a given velocity, *v*?" A reply to the query, "does a body descending on an inclined plane with an accelerated motion, press the plane with the same force through every portion of its length?" by Mr. David H. Mason.

The above papers were severally read and discussed, when, on motion, they were referred to the committee on publications.

On motion, the query, "what is the true mode of computing the power of high pressure steam engines?" was selected as the subject of discussion at the next meeting.

(Extract from the minutes.)

THOMAS FLETCHER, *Vice President.*

A. S. ROBERTS, *Recording Secretary.*

On the use of Alumina with Pigments designed for the Pallet. By A. A. Hayes, *Roxbury Laboratory.*

In preparing his paints, by levigating pigments with oil, the artist is often perplexed by the diversities which they exhibit after this operation. Some pigments present a chemical combination with the oil, while others can be suspended in it only by considerable labour, and soon separate when left at rest. These differences can be rendered of trifling importance, by employing such a substance as will retain those compounds which possess no attraction for the oil, in a state of uniform suspension, and whose action will be in some respects analogous to that of the gum used in inks and water colours. The property which the hydrate, or carbonate, of alumina possesses, of mixing freely with oil so as to form a transparent, consistent, and almost colourless compound, admirably fits it for this purpose. At the request of Mr. Rembrandt Peale, I prepared some pigments by mixing them with alumina while moist. When ground with oil, he found them to possess all the most valuable properties of the best colours. The tendency to separate from the oil, and the disagreeable property, which some colours possess, of becoming more fluid when an attempt to preserve them is made by immersing the pallet in water, disappear, after they have been ground with a small portion of alumina. The artist has it in his power, thus, to increase or diminish the fluidity of his paints, and to render them uniform.—Some pigments become valuable as glazing colours, as the Prussiate of copper, (Hatchette's Brown.) Vermilion and Naples Yellow, acquire new properties.

For printing from blocks, as in the manufacture of ornamental floor-cloths, it is often desirable to increase the fluidity of the paint, so as to prevent the dropping of small thread-like parts on the work, without causing it to spread. This may be accomplished, by adding a small quantity of whiting to the pigment while grinding; the artisan can then load his blocks with paint, and consequently give a thick coating to the print. [*Silliman's Journal.*

On a fine Scarlet Pigment for the Pallet. By the same.

While prosecuting some experiments on the pigments employed by artists, I prepared a quantity of the bi-iodide of mercury, and gave it to Mr. R. Peale, requesting him to make some experiments on its working properties and permanency. This distinguished artist obligingly commenced them, but they were not finished, at the time he left this country. He found that it readily mixed with oil; combined with other colours, it gave delicate and beautiful shades, and exposed for weeks to the direct rays of a midsummer sun, it remained unchanged. These properties induce me to recommend it as an addition to the number of pigments among which the artist can make a choice.

An economical process for preparing this salt, consists in boiling a mixture of one hundred and twenty-five parts of iodine, and two hundred and fifty parts of clean fine iron filings, with one thousand parts of rain water, in an oil flask. When the brown colour of the liquid is succeeded by a light green, the clear fluid is decanted, and the residue washed with warm water; the washings being added to the green solution, two hundred and seventy-two parts of corrosive sublimate, dissolved in two thousand parts of warm water, are then added to the former liquor, and the resulting precipitate is afterwards washed and collected.

This salt, either in crystals, or in powder, presents two distinct and beautiful colours. If the precipitate, obtained as above, be heated in a small subliming apparatus, or in a glass tube, it melts and sublimes copiously, and the vapour is condensed in large transparent rhombic tables, of a fine sulphur yellow colour. These crystals are permanent in the air, and unaltered by the direct solar rays; but the slightest friction, or the contact of a fine point, is sufficient to alter their interior arrangement. The point of contact instantly becomes of *a rich scarlet*, and the same colour spreads over the whole surface of a single crystal, and extends to the most remote angle, if a group of crystals be the subject of experiment. This change of colour is accompanied by a sensible mechanical motion, so that a small heap of the crystals appears as if animated. An ordinary electroscope does not indicate the development of any electricity, nor is there any considerable elevation of temperature, during the change.

By gently warming the crystals supported on paper over the flame of a lamp, the original yellow coloured salt is obtained, and the same experiments may be often repeated; affording an elegant illustration of the connexion between colours, and the mechanical structure of bodies. Transparent, but minute, rhombic prisms of this salt, may be obtained by allowing a hot solution of it, in a solution of corrosive sublimate, to cool very gradually. [*Ib.*

Singular Galvanic Trough.

M. Watkins, philosophical instrument maker, of London, has constructed a Voltaic pile, with a single metal and without any liquid. It consists of from 60 to 80 plates of zinc, four inches square, fixed in a wooden trough, at a short distance from each other, having only a thin plate of air between them. One side of each plate is smoothed and polished, the other left rough. The polished faces are all turned in one direction. If one extremity of the pile be made to communicate with the ground, and the other with an electroscope, the latter immediately indicates one or other of the two electricities, according to the pole with which it is in contact. The humidity of the air favours the action of the pile, which may be considered as a kind of dry pile in which air is substituted for paper, and the two surfaces of the zinc do the office of two heterogeneous metals. It

appears to be to the stronger oxidation of the polished surface that we are to ascribe the development of electricity in each plate of the zinc; the intermediate strata of air, and perhaps the trough, permitting this electricity to accumulate as in the ordinary pile.

Annales de Chimie et de Physique, Aout, 1828.

Differential Barometer. *By the late* Dr. Wollaston.

This instrument is capable of measuring, with considerable accuracy, extremely small difference of barometric pressure. It was originally contrived with the view of determining the force of ascent of heated air in chimneys of different kinds; but as its construction admits of any assignable degree of sensibility being given to it, it is susceptible of application to any other purpose of more extensive utility. A glass tube, of which the internal diameter is at least a quarter of an inch, being bent in the middle into the form of an inverted syphon, with the legs parallel to each other, is cemented at each of its open extremities into the bottom of a separate cistern, about two inches in diameter. One of these cisterns is closed on all sides, excepting where a small horizontal pipe opens from it laterally at its upper part; while the other cistern remains open. The lower portion of the glass tube is filled with water or other fluid, to the height of two or three inches; while the remaining parts of the tube, together with the cistern, to the depth of about half an inch, are filled with oil; care being taken to bring the surfaces of water in both legs to the same level, by equalizing the pressure of the incumbent columns of oil. If the horizontal pipe be applied to the key-hole of a door, or any similar perforation in the partition between portions of the atmosphere in which the pressures are unequal, the fluid in the corresponding half of the instrument will be depressed, while it is raised in the opposite one, until the excess of weight in the column that is elevated will just balance the external force resulting from the inequality of atmospheric pressure upon the surface of the oil in both cisterns. This, however, is equal only to the difference between the weight of the column of water pressing on one side, and that of an equal column of oil which occupies the same length of tube on the other side; this difference depending upon the relative specific gravities of the two fluids, will, in the case of olive oil and water, be about one-eleventh of the weight of the column of water elevated. But the sensibility of the instrument might be increased at pleasure, by mixing with the water a greater or less quantity of alcohol, by which the excess of its specific gravity over that of the oil may be reduced to one-twentieth, one-thirtieth, or any other assignable proportion. The instrument may be converted into an anemometer, by closing both the cisterns, and by applying to the upper part of each a trumpet-mouth aperture, opening laterally.

[*Newton's Journal.*

On a New Use of the Chromate of Potash. By M. Kaechlin-Schouch.

[From the *Ann. de l'Industrie.*]

This use of the chromate is to print a white pattern on a blue or green ground. A blue colour is first given to the cloth by means of the indigo vat, more or less deep, according to the green required; the cloth is then prepared with the aluminous mordant, and passed through hot water; it is then again prepared with an ungummed solution of bi-chromate of potash, consisting of 2½ ounces of salt to 4 pints of water. It is then printed with the following preparation:

Water thickened by roasted starch, -	4 pounds.
Tartaric Acid, - - - - - - - -	10 ounces.
Oxalic Acid, - - - - - - - -	6 ounces.
Nitric Acid, - - - - - - - -	2 ounces.

The nitric acid is unnecessary, except for delicate designs. The moment this substance is printed, the blue colour is destroyed; the cloth is instantly put into running water, and afterwards dyed in quercitron, or other dye stuffs.

This destruction of vegetable colour arises from the following general fact: whenever chromate of potash is mingled with *tartaric* or oxalic acid, or with a neutral vegetable substance, and a mineral acid, as the sulphuric or nitric, a strong action takes place, accompanied with the disengagement of heat and gaseous substances. The principal product of this reciprocal action is a new body having acid properties. During the effervescence which takes place, the mixture has the power of destroying vegetable colours. Carbonic acid is evolved during the decomposition; and when the mixture is made in a retort, there comes over a colourless liquid, slightly acid, having the odour of weak acetic acid, and reducing the nitrates of silver or mercury if heated with them (formic acid?)

When 9 parts of tartaric acid and 10 parts of chromate of potash are boiled with water, a neutral green liquid is obtained, which being evaporated, does not crystallize, but becomes a brittle green mass. When acetate of lead is added to the solution, a precipitate is formed, which being well washed and then carefully decomposed by sulphuric acid, yields a very acid green fluid, uncrystallizable, and with alkalies forming either acid, greenish-violet salts, or neutral-green salts. Cold sulphuric or nitric acids, do not act upon this substance, but being heated, they decompose it. When the acid itself is calcined, it yields green oxide of chrome.

On the Fusion of Tallow.

[From the same.]

The Council of Health at Nantes has been engaged in an investigation of the best means of fusing tallow, so as to avoid the injury and annoyance which arises from an abundant liberation of vapours, when the ordinary method is used. Much pains has been taken in acquiring all the information possible, and numerous experiments

have been made, both on a large and small scale. The best process which the council has instituted, appears to consist in using, according to M. D'Arcet's suggestion, a certain proportion of sulphuric acid, and operating in close vessels. By the use of the acid, the fumes always evolved are very much altered and ameliorated in quality, at the same time that the fused tallow is improved in quality and increased in quantity, the fusion very much quickened, and the use of a press dispensed with. By the use of close vessels, the fumes evolved can be either conducted to a fire-place to be burnt, or, if that may be thought dangerous, in consequence of the occasional boiling over of the melted tallow, can be conducted into a condensing apparatus, which is found readily to condense them.

M. D'Arcet uses 100 parts of crude tallow in small pieces, 50 parts of water, and one part of sulphuric acid, sp. gr. 1.848. In some small experiments a digester was used, having a pierced copper plate near the bottom to avoid the necessity of stirring; 1500 (316.5 oz.) parts of crude tallow, 750 of water, and 124 of oil of vitriol, were used, and the fumes conveyed by a pipe into a fire-place; half an hour's ebullition completed the fusion. The infusible matter, when pressed into a cloth, weighed only 96 parts, and was slightly acid. The tallow was white, hard, and sonorous, and *not* acid. Without the acid the same effect was not produced in an hour.

A tallow manufacturer then tried the experiment with 2 cwt. of tallow, using the acid, but operating in open vessels; 92 per cent. of fused tallow was obtained, and 8 of loss occurred. In a second large experiment with acid, only 5 of loss occurred. The residue does not require the use of a press, but cannot be made into cakes for cattle unless previously freed from acid by washing.

Experiments made on the condensation of the vapour were found to succeed very well, and thus all fear of injury from fire is avoided. The council propose conducting the vapours into the drains of the works, and so condensing them there; no annoyance being apprehended from the occasional return of the vapours into the building, as that effect can be counteracted by the use of stink traps.

Construction of Magnetic Needles.

According to M. de Legey, steel for magnetic needles should not be selected from amongst springs, for such steel is formed of fibres more or less hard, which, by the action of the hammer, has had different directions and unequal hardness given to them. M. Legey prefers German laminated steel plate, from which he cuts a strip in the direction of the length, and then draws it out so as to close the pores, till it is very brittle. From this plate he cuts the lozenge intended for the needle. All the operations should tend to lengthen the fibres in parallel directions. The steel is then to be hardened, after which it is to be moderately tempered, then polished on the wheel, and finally magnetized.

Before magnetizing the needle, it is examined, and usually found to have two poles. Whatever may have caused them, M. Legey regards the needle as more apt to receive magnetism, according to the position of these poles, than in any other direction, and, therefore, endeavours to preserve them in every operation to which the needle is subjected; thus, in the polishing, it should always be done in the direction of the length of the needles, and the southern poles should be held opposite to the course of the wheel; a proceeding which it is affirmed preserves the position of the poles. When the needle is magnetized, the same attention to its previous state is to be given. [*Bulletin de la Société d'Encouragement.*

New Razor Strops.

A new kind of razor strop, invented by M. Ferrot, has received the name of *outhegone*. From the flexibility of leather, a round edge is given to the blade, for which reason paper is used in the new strop. Two kinds of very fine paper have been manufactured purposely, with fine and homogeneous pulp, mixed in the one case with fine emery, and in the other with very fine rouge. These papers are then steeped in melted tallow, afterwards pressed to give them a smooth surface, and then cut into bands, and mounted on pieces of wood properly shaped. Each strop has, therefore, two faces, one gray, on which the razor may be rendered very sharp, and the other red, which, polishing the edge, renders it extremely smooth. The razor must be laid very flat upon these strops—they improve by a few days' use. When ineffectual from age, the surface should be rubbed with a very smooth piece of pumice, or with a little pumice powder on marble or ground glass: being then wiped with a piece of cloth, they are brought to their first state. [*Ib.*

Use of Chameleon Mineral for Marking Linen.

In many large establishments, linen requires to be marked quickly, permanently, and economically. The following is a process recommended in France: prepare a chameleon mineral, by heating a mixture of one part of oxide of manganese of commerce, and two parts of nitre, or common potash, to redness; the green substance obtained is to be preserved in dry bottles, as it changes in the air. When required for use, it is to be powdered, and mixed with its weight of pipe clay, and then water added, to make a very thin paste. It is this mixture which is to be applied to the linen, either by a brush, or a stamp, or in the manner of stencilling, or even by a pen, if it be made thin and used quickly. The green paste quickly changes to brown on the linen, and the latter being washed about half an hour afterwards, the loose particles and the potash are removed, and the marks left of a deep brown colour. This writing perfectly resists the action of alkaline lixivia, even though strong; it also resists soap and weak acids: hence the progress may be useful to calico

printers. The operation depends upon the reduction of the manganesic acid in the chameleon mineral to the state of oxide by any organized matter. The same circumstance renders it necessary to keep the substance from the contact of such bodies, and it is in its best state when recently prepared. [*Quart. Journ.*

Separation of Silver and Copper.

The amalgam obtained at the silver works at Freyberg, leaves, when decomposed by heat, an alloy of silver, copper, and other metals; the latter used to be separated from silver by boiling, and dissolving the whole in strong sulphuric acid, and then precipitating the silver. Of late, a process altogether new has been introduced. The alloy is now heated in a reverbatory furnace, exposed to air, so as to oxidize the copper, and is afterwards put into the caldrons of lead, and heated with dilute sulphuric acid, which dissolves the oxide of copper previously formed; the operations of roasting and digesting, are repeated once or twice, and many precautions are requisite to obtain a good result, but these being attended to, the process is much more economical than the ancient one. The silver is not so pure, retaining about $\frac{1}{25}$ of copper; but this is of no consequence for ordinary uses. [*Ann. des Mines*, iii. 15.

On Mr. Leigh Phillips's *mode of Heating Warehouses, &c.; and his Balista Door Spring. By* Thomas Gill, Esq. *Editor of the Technological Repository.*

It is now upwards of twenty years since the editor first saw the simple and effectual mode of applying heat used by Mr. Phillips, in warming the four stories of a cotton factory, or warehouse, belonging to his firm, in Manchester.

A *cockle*, or cast-iron oven-shaped stove, or fire-place, was erected on the ground floor of the warehouse, and heated red hot, in the usual manner; but instead of suffering the heat to escape up the chimney at once, the upper end of the flue, near the roof, was arched and turned downwards again, parallel to the first flue; and this second flue was again curved or arched at the bottom, and again carried up perpendicularly, by the side of the two others, and thus forming three flues side by side, and constituting a mass of brickwork, which, when once heated, continued to give out its heat for a considerable length of time. The last flue finally passed through the roof, and finished in a chimney; it being also furnished with a sliding register plate, near to the roof of the uppermost story of the building, in order to regulate the draught of the furnace. Mr. Phillips was highly gratified with the performance of his stove; and, indeed, we think it well deserves to be imitated by all persons who have occasion to heat similar premises.

Mr. Leigh Phillips's Balista door spring.—He took the precaution

of causing all the doors of his premises to shut of their own accord, in order to hinder the cold air from entering, and thus counteracting the effect of his heating apparatus, by applying to each door a very simple spring of his contrivance, and which he termed his *balista spring*, from its being formed in a manner somewhat similar to the ancient Roman warlike machine of that name.

This spring consisted of a piece of rope tied together at its ends, and forming a coil, which was secured above and below by being passed through two staples driven into the door frame, behind the door; the four parts of the rope received within them, at their middle part, a square piece of wood, two inches thick and four inches long, tapered away towards its ends, and having four grooves made along its edges at each end of it, for the ropes to lodge in. A mortise hole was also made through the middle of the block, in which one end of a flat bar of wood could be placed, after the ropes had been twisted together, by turning the block round within them; and the other, or longer end of the wooden bar, then acted against the door by the untwisting of the ropes, so as to close it exactly in a similar manner to the usual door springs. These cheap substitutes for the ordinary door springs, had long continued in use, and most completely answered their purpose. [*Tech. Rep.*

Notice of a Calico Printer's Drying Stove, at Manchester. By the same.

The editor has examined the above mentioned stove. It was heated by means of a red hot cast-iron cockle, placed in the middle of its ground floor; but its other floors consisted of flat *reticulated* arches of brick-work, through the apertures in which the heat circulated through the whole building. He was almost afraid at first sight, to step upon this seemingly insecure species of floor, but was afterwards convinced that his fears were without any proper foundation, and that the floors were abundantly strong for their required purpose. The rows of arches abutted against upright plates of cast-iron, with projecting ledges underneath them, on each side, upon which the bricks were also lodged; and these iron plates were supported upon cast-iron pillars, the whole being thus also rendered completely fire proof. The interstices were formed by the bricks not touching each other *endways*, although they had a sufficient bearing against each other *sideways*, to insure their firmness and stability. It must have been a bold undertaking on the part of the architect who first constructed such a floor! [*Ib.*

On a Cheap and Simple Crane. By the same.

In a cotton warehouse several stories high, at Manchester, Mr. Gill examined a cheap and simple crane, the construction of which he thus describes. It consisted of what is termed a rag-wheel, or

a wooden wheel of six feet in diameter, around the rim of which were driven, at equal distances, a number of pieces of iron, made in the form of the letter Y, and around and between the forks of which pieces of iron, an endless rope or cable was passed, that descended from the uppermost room, where the crane was fixed, through all the other rooms to the ground floor, so as to be accessible in them all, and thus to raise or lower any goods, by means of a rope or chain, which was wound upon a smaller barrel, affixed upon the same axis with the great wheel, and to which rope or chain the goods were hung. Considerable use is also made of a similar rag-wheel, in raising or lowering the various machines employed in the scenery, &c. of theatres; and it is highly deserving of being employed in many other cases. [*Ib.*

Manufacture of Scotch Whiskey.

It is a remarkable fact, says major-general Stewart, in an article on the prevention of smuggling in the Highlands, inserted in the Quarterly Journal of Agriculture, that a spirit of the best quality and flavour has been distilled by men with their apparatus at the side of a burn, and, perhaps, changing weekly from fear of a discovery; malting on the open heath far up the hills, and hurrying on the whole process to avoid detection; yet, with all these disadvantages, they received the highest price in the market for the spirit thus manufactured. The quantity might, perhaps, be less than what could be produced by a more regular process of distillation; but then the liquor was so much superior in flavour and quality, as to compensate for the deficient quantity. Several of these men have been employed, by way of experiment, in a licensed distillery on the estate of Garth, with directions to proceed in their own way, only to be regulated by the laws under the control of an officer; yet, with the advantage of the best utensils, the purest water, and the best fuel, they produced a spirit quite inferior in quality and flavour to what they made under the shelter of a rock, or in a den, and it sustained neither the same price nor character in the market.

[*Quart. Journ. Agri.*

Preservation of Grain in Reservoirs of Clay.

A German, M. Fischer, in the *Archiv fur die gesamte Naturlehre*, tom. iv. No. 1, communicates the following plan, pursued by him in preserving grain. He erected with unburnt bricks, a square building, 28 feet on each side, and 35 feet high; the walls 3 feet thick, and the bricks well conjoined by means of clay. The floor, also, was formed of worked clay, and raised a foot above the level of the surrounding ground. This tub, as it were, being covered with a simple roofing, and thatched, and the brick-work completely dry, 1100 sacks

of dry wheat were poured into it: the wheat was covered with straw, and over this straw was placed a layer of dry clay, a foot thick, thoroughly trodden and beaten down. Several years afterwards, on the opening of this magazine, the wheat was found dry, and perfectly good; and, what is more, is said to have possessed, for the purposes of making bread and pastry, qualities, far superior to those of wheat preserved in magazines admitting air. [*London Mag.*

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On Colza Oil.

Extract of a letter from Thomas G. Clemson, Paris, to Jacob Green, M. D. Professor of Chemistry in Jefferson Medical College, Philadelphia.

Paris, September 18, 1828.

Dear Sir,—In accordance with the wish which you expressed when you were in Paris, I send you the following remarks respecting the *oil* that is burnt throughout France.

It is known by the name of Colza Oil, *Huile de Colza*, and is extracted from the grain of the Brassica Arvensis, or Campestris, a species of cabbage.

The Colza is very much cultivated throughout France and the Netherlands, on account of its various and useful qualities. In the north of France, and particularly in the environs of Lille, the greatest possible attention is paid by the inhabitants to its production. The seed is sown during the month of July, as we sow our seed for the purpose of procuring cabbage plants. The shoots are transplanted in the month of September; a cloudy day being preferred. A man goes ahead, making holes in the earth, at a distance of about twelve inches from each other; he is immediately followed by a child, who puts into each hole a single plant; a third person finishes the operation by closing the earth around the plant by means of a hoe. When the seed becomes ripe, which generally happens in the month of July of the following year, the plant is cut, tied in small bundles, and put under a shed, or any covered and airy place, to dry. The grain is beaten out, and cleaned in the manner commonly used for the extraction of wheat or other grain, and is then treated for the oil. As the oil comes from the press it may be directly used, with potash, for the fabrication of soft soap; but if intended for burning, it is necessary that it should undergo another preparation, in order to separate from it its mucilage and the colouring matter which prevents its ready combustion. We are indebted to M. Thenard for the method of purification. It consists in mixing two parts of sulphuric acid (concentrated,) with a hundred parts of *oil*, which are to be well stirred together until the acid combines with the mucilage and colouring matter, which are gradually precipitated in flakes of a blackish green colour, after which a quantity of water equal to double that of the oil is added; the whole is then freely agitated with the inten-

tion of depriving the oil of the free acid; it is then left to settle for the space of ten days, at the end of which time the oil which is upon the surface of the water is decanted into tubs, in the bottom of which are holes filled with cotton, through which the oil is allowed to filtre, when it is perfectly pure. This method of purification is applicable to all seed oils. The oil of Colza thus prepared, has very little odour, is of a yellow colour, and has a sweetish taste. It is not very soluble in alcohol. When congealed it crystallizes in small needles diverging from a centre.

Yours, &c.

THOMAS G. CLEMSON.

LIST OF ENGLISH PATENTS

Which passed the great seal, from January 27, to March 19, 1829.

To John Hopper Carrey, Goldsmith and Jeweller, for certain improvements in the construction of umbrellas and parasols—Jan. 27.

To James Fraser, Engineer, for a new and improved arrangement of a flue, or flues, to communicate with the various parts of culinary apparatus; such as steam, soup, or water boilers, oven or ovens, hot plate or plates, hot closet or closets, and stewing stove or stoves, to render them more compact; and also to appropriate part of the said apparatus to effect other useful purposes—January 27.

To John Braithwaite and John Ericsson, Engineers, for a mode or method of converting liquids into vapour or steam—January 31.

To Robert Parker, a lieutenant in the Royal Navy, for an improved drag, or apparatus, which is applicable to stage coaches, and other wheel carriages; and whereby the motion thereof may be retarded, or stopped, when required—January 31.

To Joseph Rayner, Civil Engineer, for certain improvements in apparatus and machinery, for conducting heat and applying the same in the operations of washing, scouring, cleansing, fulling, dressing, dying, and finishing woollen cloths; and in callendering, straining, glossing, polishing, and finishing, silks, cottons, linens, woollens, and all other goods, to which the same may be applicable—February 5.

To Julius Pumphrey, Glover, for certain improvements in steam engines, and machinery connected therewith, to propel steam boats, and vessels; some parts of which improvements are also applicable to other purposes—February 5.

To John Burgis, Ornamental Paper Manufacturer, for a method or methods of gilding or silvering certain woven fabrics, in burnished, or burnished and dead, or matted gold and silver; and which said fabrics may be used as gold or silver, and lace borderings, and for other purposes—February 5.

To Alexander Daninos, for a certain invention for the manufacture of improved hats and bonnets, in imitation of Leghorn straw hats and bonnets, which invention was communicated to him by a foreigner residing abroad—February 5.

To Richard Green, Ship Builder, for certain improvements in the construction of made masts—February 5.

To William Henry Kitchen, Ironmonger, and Andrew Smith, Merchant, for certain improvements in the construction of window frames, sashes, or casements, shutters, and doors, designed to afford security against burglars, as well as to exclude the weather—February 7.

To Edward Heard, Chemist, for a certain improvement, or improvements, in illumination, or producing artificial light—Feb. 12.

To Samuel Walker, Cloth Manufacturer, for an improved apparatus, which he denominates "an Operameter," applicable to machinery for dressing woollen or other cloths—February 20.

To George Hayden, Engineer, for certain improvements in machinery for dressing cloths—March 2.

To William Storey, Plumber and Glazier, and Samuel Hirst, Clothier, for certain materials, which, when combined, are suited to be employed in scouring, milling, or fulling, cleansing and washing, of cloths and other fabrics; and by the employment of which materials, considerable improvements in those processes are effected—March 10.

To Richard Hall, Tailor and Woollen Draper, for a composition applicable to certain fabrics, or substances, from which may be manufactured boots, shoes, and various other articles—March 10.

To James Willis Wayte, Printer, for certain improvements in printing machinery—March 19.

LIST OF FRENCH PATENTS

Granted in the second quarter of 1828.

[Concluded from page 368, vol. III.]

To Thomas Preston, of Dichy, for improvements in manufacturing rolled, or sheet lead—10 years.

To Auguste Noverre, of Paris, for a machine to manufacture dough for bread and biscuits—10 years.

To Antoine Perpigna, of Paris, for a new evaporating apparatus —10 years.

To François Rever, of Conteville, for a gas bottle emptier—5 years.

To Theodore Parquin, of Paris, for a process for manufacturing coffee pots of tinned copper, called "Levant Coffee Pots"—5 years.

To Labarthe, of Paris, for a new lamp nozle—5 years.

To Liebaut, of Paris, for apparatus for bleaching sugar and sirops —5 years.

To Jean Joseph Giraud, of Bagnols, for a machine to wind silk from the cocoons—5 years.

To Auguste Moineau, of Paris, for a continuous moving power, applicable to machines, as to time pieces—15 years.

To Morel, Garnier, and Suireau, of Paris, for a new arrangement in hydrostatic lamps—5 years.

To Antoine Gaily Garalat, of Versailles, for an aerostatic lamp—10 years.

To Feliz Haize, of Paris, for manufacturing horse shoes by a stamping machine—10 years.

To Jean Clavé, of Haute Marne, for double bellows with a flexible division—5 years.

To Victor Odent, of Courtalin, for a machine to manufacture paper with economy and ease—5 years.

To Jean Queyras, of Camoret, a furnace, or heater, for two vessels; for unwinding cocoons—5 years.

To John Nicholson, of Paris, for a paper ruling machine—10 years.

To Jacques Debenzis, of Paris, for elastic stuffing to sophas—10 years.

To Thomas Hall, of Amiens, for embossing stuffs of cotton, wool, or silk, intended for furniture—5 years.

To Bruneaux and Denormand, of Retel, for moveable wool combs operating by an eccentric—5 years.

To Cesbron, of Paris, for a hand mill for grinding grain—10 years.

To Chateaneuf and Grandboulogne, of St. Jean de Royans, for fulling apparatus for manufacturing hats—5 years.

To Etienne Leblanc, of Paris, for buttons, called "Diana Buttons"—5 years.

To Roux, of Paris, for a pressure safety lock—5 years.

To Louis Halette, of Arras, for apparatus for the manufacture of sugar from beet-root—10 years.

To Prosper Meynier, of Lyons, for machinery to weave several damask ribands at one operation—10 years.

To Pierre Dumontier, of Pantin, for a method of using pit coal in preparing plaster of Paris—5 years.

To Lemoine, of Paris, for improvements in 'Pauly's guns'—5 years.

To Naudot & Co., of Paris, for a machine for manufacturing bricks, tiles, &c.—15 years.

To Louis Darche, of Paris, for an economical apparatus for heating and cooking—15 years.

To Louis Ledru, of Clermont, for the application of *domite* in the arts—10 years.

To Jean Moulliere, of Surgeres, for a furnace for the distillation of brandy—5 years.

To Lemoine, of Paris, for wind cushions—5 years.

To Cyprian Prosper Brard, of Frejus, for making paper from wood—5 years.

To Bunten, of Paris, for a barometer, in which the tube and cistern are of a new construction—5 years.

To Bricaille, of Paris, for a moveable spelling table, to teach reading in a short time—5 years.

To Witz, of Cernay, for a new process for spinning cotton and other fibrous materials.

To Petit Pierre, of Paris, for a new method of casting music—5 years.

To Julian Dumont, of Paris, for improvements in his sugar-clarifying apparatus—10 years.

To Bernard Bonnet, of Nantes, for machinery to manufacture iron thimbles employed in the rigging of vessels—10 years.

To George De Bovier, of Paris, for a method of varnishing or japanning, in a variety of colours, clasps, pins, &c. for head dresses, and other small metallic articles—5 years.

To Gaspard Christian, of Paris, for a new system of operations in the spinning and preparing silk for various purposes—15 years.

To Charles Derosne, of Paris, for processes in cleaning and bleaching of vegetable saccharine juices, and in various operations in the refining of raw sugars—15 years.

To Aimé Bourbon, of Paris, for hydraulic machines for ascending rivers, and draining marshes—15 years.

To Jean Escofier, of Bordeau, for an hydraulic machine, with a fixed inclined plane and axis, worked by horse power—5 years.

To John Nicholson, of Paris, for a machine for shearing cloth—5 years.

To Madame Fournier, of Paris, for improvements in parts of the dresses in males and females, and particularly in corsets for the cure of defects in the shape—5 years.

To Jean Foucault, of Paris, for newly invented iron wheels, with double spokes, for carriages, and particularly for artillery—5 years.

NOTICES.

The communication on *Inertia*, is in the hands of the printer, and will appear in the next number.

The cuts required to accompany the solution of questions discussed at the monthly meeting of the Franklin Institute, are in preparation, and will be ready for the next number; when the communications of Mr. Charles Potts, and of Mr. D. U. Mason, will appear.

The article relating to "Walker's Refrigerators," which are represented in the plate, has been crowded out, but will be inserted in the December number.

Persons who write to the Editor, on the subject of the Journal, are requested always to *pay the postage;* the *profits* will not enable him to do so.

Individuals living in remote places, where there are no agents to guarantee the payment, are expected to remit the money when they order the Journal. Those who are fearful of trusting the Institute, must expect a reciprocity of feeling.

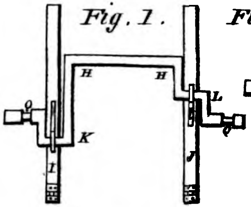


Fig. 1.

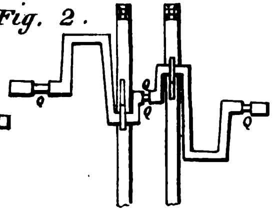


Fig. 2.

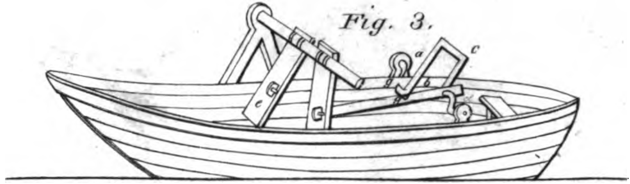


Fig. 3.

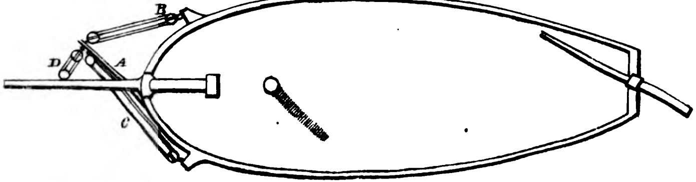


Fig. 4.

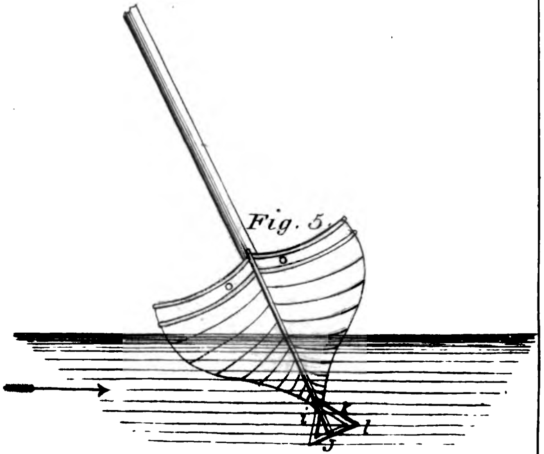


Fig. 5.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

DECEMBER, 1829.

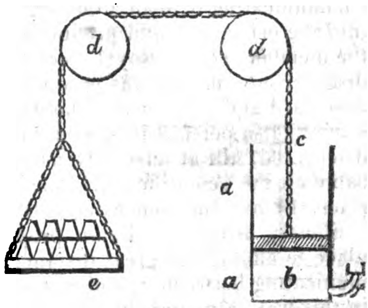
On the Early History of the Steam Engine.

[Concluded from p. 327.]

To proceed with the historical series, it may be mentioned, that about this time Otto Guericke was engaged in those experiments and speculations which led to the invention of the air-pump,—to a better knowledge than had hitherto been obtained of the air's weight and elasticity, and, particularly, of the powerful effects of that weight and elasticity when excited by an exhausted, or partially exhausted, space.

Otto Guericke, in his work on the subject, published in 1672, describes numerous contrivances for exhibiting, or using mechanically, the weight of the air. One apparatus he describes similar to that in *Fig.* 8, where *a*, *a*, is a cylinder, to which is fitted a piston, *b*, attached to a chain, *c*, which passes over the pulleys, *d*, *d*, and supports a loaded scale, *e*. A pipe, *f*, enters the cylinder near the bottom, and to this pipe a pump is to be attached, by whose means the air may be withdrawn from the lower part of the cylinder, which will, of course, cause the piston to be forced downwards by the unbalanced pressure of the atmosphere. In this way Gue-

Fig. 8.



ricke says that a boy of twelve or fifteen years old, acting on the pump at *f*, may raise a weight, however large, in the scale *e*, provided only that the diameters of the pump and the cylinder, *a*, be properly proportioned.

This, it will be perceived, is an anticipation of the principle of Bramah's hydrostatic press; not that it at all interferes with the credit due to Mr. Bramah for that beautiful invention, because he claimed no discovery of new principles, but a better application of those which were old.

In this apparatus of Otto Guericke, which is fully described by a very large picturesque engraving in his work of 1672, we have a complete explanation of the principle of obtaining power from a vacuum formed under a moveable piston. It is quite clear, also, that the mode of producing a vacuum, by means of condensed steam, was known and published at this time. If, therefore, any one had proposed to Guericke, to make the vacuum by condensing steam, instead of by a pump, there would be no vast stretch of ingenuity in the suggestion. But suppose Guericke to reply, "how shall I apply the steam?" Imagine, then, that he is thus answered:—"place a little water in the bottom of the cylinder, then set the cylinder on a fire till the water is converted into steam, and the piston is at the top; secure the piston from descending, and carry the whole apparatus to wherever the work is to be performed, then fix the cylinder, attach the piston to the point where your power is to be applied, and as the cylinder cools, your work will be done." If Otto Guericke were a man of business, he would reply, this will cost about ten times as much as exhausting the cylinder by hand. So that this suggestion, besides possessing the smallest possible quantity of originality, would have the property of being utterly inapplicable to useful or economical purposes.

About the year 1685, Monsieur Papin communicated to the Royal Society and others, various devices for using compressed and rarefied air to elevate water in jets or pipes. In none of these is there a particle of novelty, as will be evident to whoever will compare them with the works of Hero and his translators. He contrived an apparatus of this sort, which he decorated and placed as an ornament on his chimney shelf, but he concealed within the shelf a pipe communicating with an adjoining room, through which air was forced into the ornament, and produced a jet of water. This he invited the members of the Royal Society to see, and challenged them to discover how the jet was produced. The mysterious ornament was described and published without reference to the concealed pipe, and some foolish persons imagined that the perpetual motion had been discovered; till at length Monsieur Papin disclosed, what it is probable all the scientific world had long known,—that the effect was produced by some concealed artifice.

Shortly after this, Papin proposed to convey motion from one place to another, at great distance, by means of air-tight tubes communicating between cylinders containing pistons. He thought that, in this way, a motion in one cylinder could be transferred to an-

other at the distance of a mile or more. This is something like the scheme which has been lately before the public, of starting a carriage from London by means of an air-pump at Brighton.

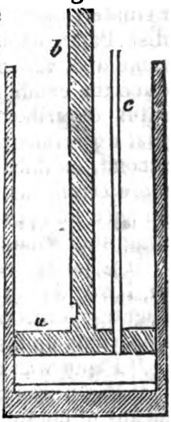
Any person who could seriously propose to work a piston in a cylinder at one end of Oxford street by means of an air-pipe, communicating with a second cylinder at the other end, must be ignorant of what ought at that time to be fully known, namely, that air was inert like other matter; that it was elastic, and that in pipes its motion was retarded by friction.

In 1669, Papin copied Otto Guericke's contrivance, and describes it as his own invention; whereas the only change he makes, is in causing the descent of the piston to express oil from seeds instead of raising a weight. This is a mere plagiarism.

From about 1685 to 1700, therefore, it appears that Monsieur Papin was engaged in forming contrivances to employ the force of exhausted or compressed air upon pistons in cylinders.

In 1688 he suggested the use of gunpowder to form the vacuum by its explosion, and in 1690 he proposed to form the vacuum by steam from a small quantity of water placed in the cylinder.

Fig. 9.



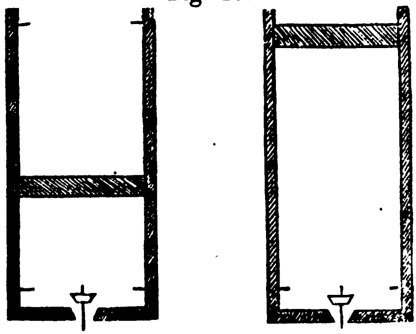
In *Fig.* 9, the cylinder of Papin is described; *a* is the piston, and *b* is a rod attached to it. There is a notch in the rod just above the piston, into which a catch, fixed on the top of the cylinder, enters, and retains the piston at the upper end till the catch is released. The tube, *c*, permits the escape of the air when the instrument is first used. The fire is brought under the cylinder, and retained there till the water is converted into steam, and the piston driven up. The piston is then secured by the catch, the fire is removed, the cylinder gradually cools, and at length the piston, being set at liberty, descends under the pressure of the air.

This is the apparatus on which M. Arago founds the completion of the claim of France to the honour of having invented the steam engine. It was never made as a working machine, and it does nothing more than illustrate a well known physical fact. That a vacuum was left by condensed steam, was known from the time of Hero at least. That the air, or some other power, would force a liquid or solid body into vacuum, was equally well known.

But let us see how M. Arago treats this matter. The section introducing this subject is headed "Denis Papin," and immediately under are placed the two diagrams, *Fig.* 10, which the reader, of course, concludes are the portraits of Papin's invention. But it will hardly be believed they are nothing of the sort; they are portraits of the apparatus of the Englishman, Newcomen, made fifteen years afterwards. M. Arago gives six pages of description of this apparatus, in which he brings the steam into the cylinder from a boiler through the valve, *a*, and which he says is very clearly described in the Leipsic Acts for 1688, and in a work of Papin's in 1695; and

he details certain experiments made with a cylinder which weighed five ounces.

Fig. 10.



At the bottom of the sixth page M. Arago proceeds: "The water which furnished the steam in these *first* experiments was not contained in a separate boiler—it had been placed in the body of the cylinder, upon the metal disk which closed the lower end. This disk Papin warmed to convert the water into vapour; and it was the same disk which cooled when the fire was removed in order to produce the condensation." From this we conclude that, as the apparatus described by M. Arago was not that used by Papin in his *first* experiment, of course it must be the apparatus used in Papin's second, or third, or last experiments. Nothing, however, would be more erroneous than such a conclusion. Papin never experimented on such an apparatus as M. Arago ascribes to him, he never even suggested such a one.

It is for the reader to judge of the fairness of ascribing to Papin in 1690 the invention of Newcomen made in 1705, without the slightest hint that such a substitution has been made. M. Arago thus sums up his notice of Papin:—

"Papin was the first to imagine a steam engine with a piston.

"Papin was the first who saw that aqueous vapour furnished the means of obtaining a vacuum in a *large space* (grande capacité.)

"Papin was the first who thought of combining in the same fire machine, the action of elastic vapour with the property of the same vapour to become condensed by cold."

If Papin's apparatus be a steam engine, he is entitled to such a share in the invention of that agent, as appears due to the novelty of his contrivances, and to their practicability. The reader may easily judge of each.

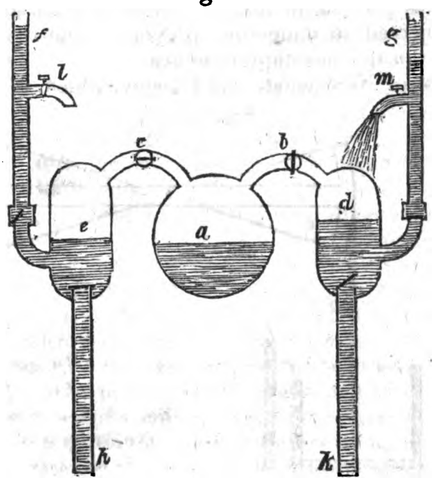
Papin was not the first by two thousand years who saw that condensed aqueous vapour left a vacuum. What differences there are between large and small spaces in this respect remain to be shown. The capacity of a five-ounce cylinder hardly deserves to be called a large space.

Papin's apparatus does not use both the elastic force and conden-

sation of the steam; and if it had, he was not the first who combined in the same machine the elastic force of the vapour and its condensibility; for Hero's apparatus does the same thing.

We proceed to the year 1699, when Mr. Savery exhibited to the Royal Society a model of the first engine, which is known to have been realized on the large scale. This model and its mode of action will be rendered intelligible by the diagram, *Fig.* 11, where *a* is a boiler communicating by the bent pipes *b* and *c* with the cold vessels

Fig. 11.



d and *e*: *f* and *g* are the pipes through which the water is forced out of the vessels by the steam, and *h*, *k*, are the pipes by which it enters these vessels from the well or cistern beneath. The arrangement of valves is precisely like that supposed in the Marquis of Worcester's, *Fig.* 7, and the only difference is, that here the cold water ascends into the vessels *d*, *e*, instead of flowing from the same level, and that the cooling of the vessels *d*, *e*, is hastened by suffering cold water to run upon them alternately from the cocks *l*, *m*. This last contrivance, the artificial condensation, is the only point of complete novelty about Savery's machine. He has, however, the rare merit of combining several principles which had been merely suggested, in an apparatus which presented to the world, for the first time, an effectual working machine for raising water by fire.

But we must now hear M. Arago.

His section headed "Savery," thus begins: "We have no proof that Salomon de Caus ever constructed his steam engine;" I might say as much of the Marquis of Worcester. "That machine of Papin, in which the action of the vapour and its condensation are successively employed, was executed only on a small scale. The reader will form an exact idea of Savery's, if he recollects that of Salomon de Caus, and attends to the following considerations."

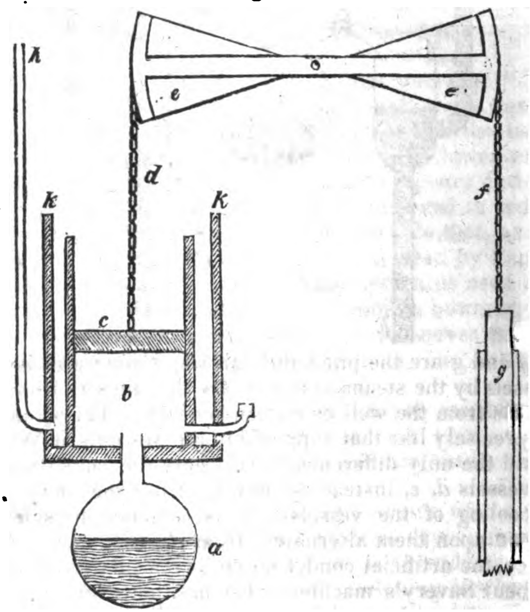
Thus the only description which M. Arago gives of the first work-

ing steam engine mankind ever saw, is by stating verbally, without any diagram, where it resembles and where it differs from what he calls the steam engine of Salomon de Caus. It will now be seen why M. Arago elongated the jet and valve of de Caus's diagram into indefinitely extended pipes; evidently for the purpose of assimilating them to the pipes *f*, *g*, *h*, and *k*, of Savery's engine.

In the year 1705, a patent was granted to Newcomen, Cawley, and Savery, for a steam engine, which was invented by the two former, and which was the first that ever became extensively useful; for Savery's was limited to inconsiderable heights, unless the vessels were subjected to dangerous pressures, and it was, moreover, very expensive in its consumption of coal.

The machine of Newcomen and Cawley, which is still partially

Fig. 12.



used where coals are cheap, consists of a boiler, *a*, from the upper part of which a pipe enters the bottom of the cylinder, *b*, in which works the piston, *c*, attached to the chain, *d*, whose upper end is fixed to one extremity of the beam, *e*, *e*. From the other end of the beam hangs the chain, *f*, supporting the pump rod, *g*. A communication is opened between the boiler and the cylinder by moving a valve; the steam enters the cylinder, and the piston is raised by the weight of the pump rods. When the piston is at the top of the cylinder, the communication between the boiler and cylinder is closed, cold water is then suffered to flow through the pipe, *h*, into an outer cylinder, or case, *k*, *k*, which surrounds the cylinder, *b*. The space

between the two is then filled with cold water, which rapidly condenses the steam under the piston, produces a partial vacuum, and causes the descent of the piston with a quantity of power proportioned to its area, the weight of the atmosphere, and the perfection of the vacuum.

This engine, after it had been so far completed as above described, cost the patentees seven years' labour and experience before it became an economical machine for draining. Notwithstanding that, according to M. Arago, a "proper machine for draining" had been in existence ever since the work of Salomon de Caus, in 1615; and notwithstanding that Papin had, in 1690, published (he says) "the most clear and methodical description of the engine known at present by the name of the Atmospheric Steam Engine."

The engine of Newcomen, which M. Arago admits to be the first that rendered any considerable services to industry, he describes as he does Savery's, without a diagram. He says, that "excepting some very essential details, it is nothing but the machine proposed in 1690 and 1695, by Papin." Excepting some very essential details, it is merely the machine of Hero. M. Arago never gives the slightest hint that he has put Newcomen's valve and boiler to Guericke's cylinder, and ascribed the combination to Papin; he says, that "both Papin and Newcomen produced the condensation by cold, though the English mechanic adopted a better plan of cooling for a working machine than that which had been employed by Papin in his model;" and he proceeds, "The machine of Papin thus modified as to the manner of cooling the aqueous vapour, excited to the highest point the attention of the proprietors of mines."

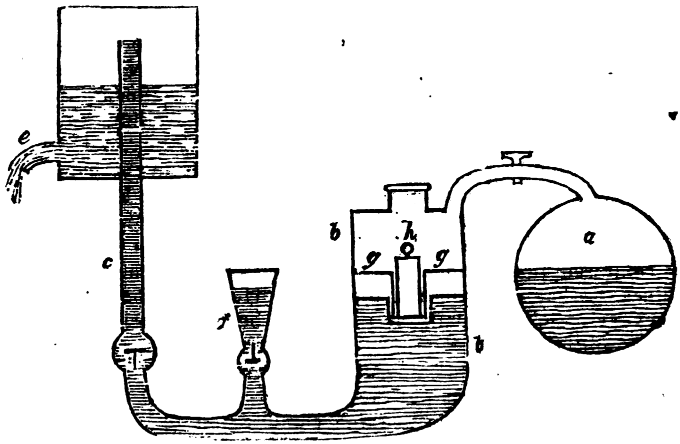
In this last paragraph there is not merely a continued suppression of the fact, that the apparatus described as Papin's is not Papin's, but Newcomen's; there is a direct assertion that the two machines differed only as to the manner of cooling the vapour.

The "modification" which M. Arago thus misrepresents as to its extent, and which he accounts of so little consequence, made all the difference between exciting the attention of proprietors of mines, and exciting no attention at all. Papin's steam cylinder lay unnoticed and undisturbed, and apparently forgotten, not only by the world, but by Papin himself; for no sooner had Savery succeeded in perfecting and realizing his machine, than Papin abandons his cylinder, seizes upon Savery's engine, mutilates it, and publishes it in 1707 as his own.

Fig. 13 describes this last and most palpable plagiarism, which Papin tells the Royal Society will so much increase the power of mankind, that he fears he shall be considered chimerical; he says further that it is much superior to the apparatus he had published some years before, and that he invented it without being aware of Savery's invention, which was (*he says*) not communicated to him till the year 1705. Papin omits the best part of Savery's apparatus, namely, the ascending pipes from the reservoir to the cold water vessels, and he claims this as an improvement. Thus he throws

aside the only part of the contrivance which modern engineers have been able to use with any regard to economy.

Fig. 13.



The boiler, *a*, communicates with the cylinder, *b*, *b*, and the steam forces the water up the pipe, *c*, into the vessel, *d*, whence it escapes at *e*. The supply of cold water to be raised takes place at *f*. There is evidently not the slightest novelty in this machine so far; it is much beneath Savery's in every respect. It has, however, one novelty, from which a tolerably fair estimate of Papin's mechanical talents may be formed. The water in the cylinder, *b*, *b*, instead of being exposed to the steam, as in Savery's engine, is covered by a floating hollow piston of iron, *g*, *g*, supporting an iron heater, *h*, which is put in and taken out like the heater of a tea-urn. No two contrivances more absurd and wasteful than these were ever devised. The professed object of the hollow iron floater was to prevent the condensation of steam on the surface of the cold water. But even a hollow iron floater is a better conductor of heat than water, when the heat has to descend, and, therefore, the appendage is worse than useless. The iron heater to be put in and out at intervals is almost too ridiculous to notice, because, at the best, a certain quantity of heat applied in that manner could produce no greater effect than the same additional quantity applied to the boiler; while it is evident that the trouble of opening the cylinder, and exchanging the cold for the hot iron, together with the loss of heat in passing through the air, would more than destroy all that was gained. The whole contrivance is puerile in the extreme, and it is the work of Papin, of whom M. Arago says, "the man of genius is always misunderstood when he advances before his age."

The reader is now in possession of the stolen and disfigured child for which Papin deserted his former doubtful offspring, "the clear and methodical description of the Atmospheric Steam Engine;" and

it will now be easy to estimate the respective claims of Egypt, Italy, France, and England, up to the year 1707.

But in fact the steam engine was hardly yet invented. Newcomen's machine, though infinitely superior to every former contrivance, is a crude, imperfect, wasteful apparatus, in comparison with those which the following century brought forth. The engine up to this time is scarcely worth a dispute, even if it had been produced wholly by one man; but it is obviously the result of a succession of improvements so inconsiderable, that the whole of them do not exhibit a tenth part of the scientific and inventive resources which are displayed in the ameliorations effected by Watt alone. From the year 1705, the steam engine is confessedly a British invention. For all that is refined and economical in the development and application of the heat; for all that is ingenious in the machinery; for all that is vast in the power produced, and extensive in the purposes to which that power may be made subservient, it is notorious that the world is indebted to Great Britain. If, then, De Caus and Papin had done all that M. Arago so incorrectly ascribes to them, the great question would not be affected by it.

The reader who wishes to verify the statements here given, is referred to the "Acta Eruditorum Lipsiæ," from 1685 to 1700; to the "Philosophical Transactions" for the same period; to Papin's work, printed in 1695, at Cassel, and entitled "Recueil de diverses Pièces touchant quelques nouvelles Machines;" to Belidor's "Architecture Hydraulique" in 1725; to "Les Raisons des Forces Mouvantes," by Salomon de Caus, of which an edition, printed in 1624, is in the British Museum; to the various editions of Hero's "Spiritalia," and especially to the translation in 1606, by Porta, entitled, "I tre Libri Spiritalia," of which a copy is in the British Museum.

If any objection be made to the language here employed, in regard to a person entitled to so much respect as M. Arago, it must be recollected that the paper of that gentleman is an indiscriminating attack on the motives of several of the most distinguished individuals of the United Kingdom, not all of whom have given as much cause for suspicion as any one of the misquotations in the paper of M. Arago.

In page 176 of that paper, M. Arago says, "the greater part of the English authors," among whom he includes by name Dr. Robison and Dr. Lardner, "obstinately persist in quoting only one work of Papin, that of 1707, and refuse to take any notice of the more voluminous work of 1695."

The persons thus accused have at least the same excuse which M. Arago requires for neglecting Baptista Porta, with this additional circumstance in their favour, that they quote Papin's *latest*, and, according to his own account, his *best* contrivance, and that what they *do* quote, they quote *faithfully*. They might well be forgiven for not supposing that the promulgator of the wretched apparatus of 1707 had invented the atmospheric engine in 1695; and it might have been expected that a paper making such grave charges should

not have exhibited so many and such singular discrepancies between the representation and the truth, as have been here pointed out.

A. Ainger.

On the Filtration of Water on a Large Scale.

At a meeting of the Royal Institution, Brande gave an account of the present state of the supply of water to the British metropolis; a subject which has recently excited very particular attention, in consequence of a large portion of it being derived from the Thames, into which is discharged the larger portion of the fluid filth of that immense city. Of this fact some notice is taken in the article on Filtering, at p. 221. In the course of his remarks, Mr. Brande described the process of filtration as applicable to very large quantities of water, and gave an account of the works lately carried into effect for this purpose by the Chelsea Company, and showed a model of their arrangements for the purpose, for which, as well as for the following particulars, he was indebted to Mr. Simpson, the engineer to that company:—

"The pond which contains the filter-bed is forty-four feet square at top, and made with sloped banks, the bottom being twenty-six feet square; it is six feet deep; the mode of forming the bed was as follows:—after the pond was made water-tight, with a drain through the bank to the well, the bottom was covered with coarse gravel, in which drains were built without any cement between the joints of the bricks; they were covered with coarse gravel, and then with finer gravel, with coarse sand and finer sand, until the strata of gravel and sand were each two feet thick, both gravel and sand having been selected with care, and well washed. The reservoirs were each thirty-two feet square at top, twenty feet at bottom, and four feet deep; the low water line of them being level with the high water line of the filter-bed; the reservoirs were worked alternately on to the filter-bed, and it was regulated to filtre 12,000 cubic feet of water every twenty-four hours; and the water was remarkably pure and limpid after it had passed the bed. The silt which was stopped on the bed was regularly cleaned off with a small portion of the sand every fourteen days; the principle of the action depends upon the strata of filtering material being finest at the top, the interstices being more minute in the fine sand than the strata below, and the silt, as its progress is arrested, (while the water passes from it) renders the interstices between the particles of sand still more minute, and the bed generally produces better water when it is pretty well covered with silt than at any other time. The silt has never been found to penetrate into the sand more than three inches, the greatest portion always being stopped within the top half inch of the sand, and in cleaning the silt off, it has never been found necessary to scrape any more of the sand off with the silt than the first half inch depth, and sometimes only half that depth was removed. The small air pipes from the

drains are to prevent injury to them, or the filtering materials, by condensation or otherwise.

"The large filter-bed at Chelsea is a surface of nearly one acre, and is constructed precisely on the same principle as the experimental bed, the details of forming and working it being greatly improved and adapted to the enlarged scale. The perfecting this bed has been a work which required the greatest attention and perseverance; it was set to work, and supplied the Chelsea Company's district, for the first time, on the 14th of January, 1829, and is of sufficient capacity to filter 500,000 cubic feet of water ever twenty-four hours: it is working with the greatest success during this inclement season, and although the water on the bed is this day covered with ice five inches thick, it does not impede the filtering process.

"This filter-bed was made after the engineer had seen several similar works upon a small scale in England and Scotland, which have been at work some years, and he has combined in it the several advantages he observed in the filter-beds he examined.

"It is proposed to follow up the improvement by extending the suction pipe up the river, and pumping the water (during the last two hours of ebb tide only) into small reservoirs constructed close to the filter-bed, and the water will be filtered as it is required for the supply of the town, and the main pipes will be so constructed that none but filtered water can be pumped into them."

It will be seen by Mr. Simpson's evidence before the commissioners appointed by his majesty to inquire into the state of the supply of water to the metropolis, that the water, by filtration, could be rendered perfectly clear, excepting during extraordinary land floods, when upon a close inspection he had perceived a slight loamy colour in the water after it was filtered, which was scarcely discernible in a glass tumbler. Mr. Simpson now remarks that the water in the large filter-bed is much better than it ever was in the experimental bed.

On a mode of Rapidly Sketching effects in Chiaro-scuro, and its application to Lithography.

At a meeting of the Royal Institution, held on the 13th of March last, Mr. Brockedon offered some remarks upon a mode of rapidly sketching effects in chiaro-scuro, and its application to lithography; he stated that the process was similar to that of engraving in mezzotinto, which he thus described. Upon a smooth surface of a plate of steel, or copper, the artist lays what is termed a ground by means of a cradle, a steel instrument, having a serrated edge, which, by a rocking motion, is made to pass all over the plate, and in every direction: this raises a burr, upon which, if printer's ink be laid, it will deliver a uniformly black impression. Upon this rough or raised surface the design is made; and the intended forms are produced by scraping off the burr to the depth of tint required, or if necessary scraping it smooth, that in such parts as no burr remains upon to

hold the ink, the surface of the metal would wipe clean, and such parts would appear white in the impression. In a similar way the new process consists in blacking the surface of paper with any mixture of black and a greasy substance, and then with a knife, or scraper, removing it from such parts as are intended in the design to be white or light. Mr. Jackson, the Royal Academician, appears to have been the inventor of this process. Some clever specimens of landscape sketched in this way by Mr. Harding, were shown by Mr. Brockedon, as well as some drawings of his own, of draped figures. One of these was produced in the short space of twenty minutes, and the other in half an hour. The material which he employed was ivory black, prepared in the usual way as for painting in oil; this was rubbed over a white Bristol board with a brush, and the drawing immediately proceeded with. Sketches and studies made in this manner in oil colour, when finished and dry, if worth preserving, may be safely kept, and are not liable to injury from rubbing.

In the application of this process to lithography, lithographic ink is laid over the surface of the stone in a fluid state, and when dry, it is scraped off where required with a mezzotinto scraper, and the designs executed with great facility. Any degree of tint may be produced; parts may be repaired or altered, minute white or black lines, or dots, which it would be difficult to produce on metal, may, in lithography, be made by scratching out with the point of a knife or needle, or drawing dark lines with a camel's hair pencil and lithographic ink, where such lines are required upon places where the ground has been removed. In this way sketches of great boldness, or drawings of extreme delicacy, may be produced. The process of printing from drawings thus executed is certain in its operation, which is not always the case in lithography, when the design is drawn on the stone; as a delicate tint can only be obtained by a fine point on the lithographic chalk and light execution, which, when finished, is liable to be injured by the operation of printing. On the contrary, by this process, the ink being laid on fluid, firmly and perfectly adheres to the stone; it is known that above 100,000 impressions have been taken from lithographic writing which has been laid on with fluid ink. Beautiful and various grain may be obtained on the surface of the stone equal to the tints from metal. The stone employed in lithography is capable of receiving the smoothest surface; but the grain which appears in the print depends upon the degree of the fineness of the sand which is used in finishing the surface of the stone, which may be made to produce a variety and fineness in the grain of the tints similar to those which are so delicate and beautiful in Mr. Martin's celebrated plates in mezzotinto upon steel. Mr. Brockedon acknowledged the assistance which he had received in his experiments from Mr. Hulmandel and Mr. Harding, and exhibited a head the size of nature, which was printed from a drawing made on stone, with which Mr. Hulmandel had obliged him. He also showed a lithographic print by Mr. Westall, and some spirited

lithographic prints by Charlet, a French artist, which displayed many varieties of this new or improved process.

Manufacture of Glass for Optical Purposes.

At a meeting of the Royal Institution on the 12th of June, Mr. Faraday gave some account of his experiments on the manufacture of glass for optical purposes.

It is pretty generally known that a committee and a sub-committee of the Fellows of the Royal Society have been formed to experiment upon the production of glass fit for optical purposes, *i. e.* free from blebs, spots, streaks, and above all, waves and striæ, so that it may have a uniform action upon light. The sub-committee consisted of Messrs. Herschel, Dollond, and Faraday, who each took those respective parts of the investigation which accorded with their particular pursuits. The Royal Society some time since applied to the Royal Institution for leave to erect upon the premises of the latter a furnace and furnace-house for the performance of numerous experiments of investigation, which was immediately granted, and which has now been in operation twenty-one months. Mr. Faraday stated that although he ought to make the first official report of his progress to the president and council of the Royal Society, yet he had been permitted, in consideration of the present evening being the last of the meetings of the Royal Institution, to anticipate, and lay before the members of the latter, in a verbal report, an account of his proceedings.

A brief account was then given of the great discovery made by John Dollond, in 1758, of the construction of achromatic object glasses; of the consequent demand for good glass; of the attempts of Guinand, Frauenhofer, Bontemps, Lerebours, &c.; and of the difficulties, great as ever in this country, if not also in France, of getting good glass.

Mr. Faraday then minutely described the nature of the peculiar optical glass, which, for the last nine months, has had his undivided attention, and also the process of working it, which was illustrated by all the apparatus. Ordinary flint glass may be considered as a compound of oxide of lead, silica, and alkali. Faraday's heavy glass is a compound of oxide of lead, silica, and boracic acid: alkali is found to be very injurious in it. It is readily fusible at a red heat, and after the materials, perfectly pure, are mixed and fritted into a rough glass in earthenware crucibles, the required portion is transferred into a platina vessel, and completed by stirring and other operations until it is perfectly uniform and clear, and fit to be cooled and annealed.

Mr. Faraday stated that he had been racing against time, and had not lost the match, for that a piece of glass, which he hoped would prove nearly unexceptionable, had been taken out of the furnace, and was in the hands of Mr. Dollond to be manufactured into a telescope. It had, indeed, been formed into an instrument, and by such

inspection as time had allowed, was good, but it wanted a still more rigid examination. Three telescopes of this glass had been made; every instrument was an improvement upon the former, and the experiments generally had advanced towards perfection from first to last. Although very anxious not to excite hopes which would not be justified in the fullest manner, still the doubts Mr. Faraday entertained of perfect ultimate success seemed very slight.

On the Flowing of Sand under Pressure.

A YEAR or two since, M. Huber Burnand described an anemometer to the Philosophical Society of Geneva, in which the force and duration of the wind were ascertained by the quantity of sand which escaped from an aperture varying in its size with the wind. In consequence of conversation relative to the manner in which sand would flow, and how far it would accord with liquids in this respect, M. Huber undertook a set of experiments which have given some very curious and interesting results: these we shall endeavour very briefly to abstract.

To obtain a regular fall of sand, it must be well sifted, but must not be too fine. That which will just pass through a sieve containing 38 wires per inch in one direction, and 45.6 in the other, flows with great facility; but the aperture must never be less than .079 of an inch in diameter. The sand, in the experiments, was generally contained in wooden boxes, closed at the bottom by four moveable plates, so that the aperture could be widened or lengthened at pleasure, the edges of these plates being bevelled on the exterior. The sand which had passed the aperture was estimated both by weight and measure.

The quantity of sand which flows in a given time through a given aperture is the same, whatever be the volume, the weight, or the height, of the sand in the box above. The height was sometimes increased tenfold without change.

When the aperture was from .078 to .118 of an inch in width, the quantity of sand which passed was always directly as the length of the aperture; but the least increase in the width occasioned an increased quantity greater than in the direct ratio of the areas of the apertures. The first part of this result may be useful in the construction of numerous instruments.

Sand passing out by lateral apertures made in the *surface* of the boxes flowed with equal velocity, whatever the height of the column within; but if these lateral apertures were made in the form of horizontal holes, and the diameters were not nearly equal to the length, not a grain of sand would pass.

Sand being poured into one leg of an inverted syphon, did not mount in the other. It extended but a very little way into the horizontal part.

Whatever pressure be given to the upper surface of the sand, it

exerts no influence on the issue below. From a quarter to half a hundred weight produced no difference.

A rod placed upright in the sand, directly over the aperture, descended without any inclination, in a very regular and uniform manner. When placed between the centre of movement and the border of the box, it also moved regularly, but gradually became inclined.

M. Huber remarks that there is, perhaps, no other natural force on the earth which produces by itself a perfectly uniform movement, and which is not altered either by gravitation or friction, or the resistance of the air: for the height has no influence; friction, in place of being an obstacle, is the regulating cause; and the resistance of the air, within the column, must be so feeble as to be altogether insensible as a disturbing force.

Single grains of sand placed upon a flat surface did not roll until the inclination of the surface was at least 30°, sometimes almost 40°. The angle formed by a heap of flowing sand is almost always between 30° and 33°; very rarely as much as 35°. Small shot and peas produced the same general effect as those described with sand.

An egg was put at the bottom of a box, and covered a few inches deep in sand: a weight of 60 lb. or more, placed over it, did not injure or affect the egg. The same result took place when the sand at the bottom of the box was put in motion by opening the aperture. Hence it is evident that the sides of the vessel support the pressure almost entirely; and also that the egg is protected from the irregular action of the pressure by the sand, to the same degree, though not in the same manner, as if in a liquid.

Other experiments fully proved that the pressure of the sand was principally sustained by the sides of the vessel. An inverted syphon had a little mercury poured in until both limbs were partly filled, and then sand was poured in on the one side upon the mercury: no elevation of the mercury in the other leg took place. Pressure was added to the weight of sand, still the mercury remained unmoved. More delicate experiments, by means of balances, showed the same effect.

A simple paper tube was rolled up; a plug fitting very loosely into the end, but not so that sand could pass it, was floated by a cork or otherwise, on water, with such buoyancy as to be able to sustain the little cone of sand that its circular surface could receive, and then the tube was held in the hand over it. On pouring sand in, the tube might be filled without displacing the floating plug below, although there was weight enough to sink plug and tube, and every thing else, if the hand had been taken away. The sides of the tube, in fact, supported the sand.

From these, and other experiments, it was concluded that it would be exceedingly difficult to *push* sand out of a tube; and upon trial, this was found impossible: the sides of the tube gave way first. Even when inclined 20° downwards, it could not be done. It is easy, therefore, to see how, in the blasting of rocks, sand is as effectual for closing the hole as a plug, the most compact driving, or any thing else.

A very simple mode of showing the most striking of these effects, is, to prepare an open tin tube, an inch in diameter, and of any length; to press a piece of thin paper against the end of it with the hand; to moisten the edges of the paper; and, replacing it, to let it adhere simply by such moisture; then placing the tube upright, with that end upon the table, to fill it with sand, and afterwards gradually to raise it. Whatever the weight of the tube and its contents, it may be carried any where in that position, although the paper bottom adheres but very slightly. [*Bib. Univ.* xl. 22.

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*On the nature, causes, and prevention of the Dry Rot.**

The vast losses that national property has sustained from the destructive effects of the dry rot on our shipping, sufficiently prove the importance of all endeavours for its prevention and investigation.

The dry rot in ships seems comparatively to be of no very remote origin, as it is only about sixty years since, that much notice was taken of it in publications on naval subjects, and its ravages appear to have increased more as we approach nearer to the present time, if we may judge from the more frequent and more earnest attention, that it has experienced within that period. This consideration gives very great importance to the opinion of those who maintain that the great prevalence of this mischief in latter times, has been caused for the most part, if not entirely, by the introduction into the national forests of a species of oak by no means indigenous to the country; and, as this may be traced to the time of the reign of William III. and the commencement of that of Queen Anne, if dry rot proceeded from the use of this timber, it would naturally appear when the plants, then put into the earth, would have attained the size proper for ship building; which will be found to correspond very nearly to the period to which we have alluded, when this evil first seems to have much attracted public observation. We have many instances of ships built before this species of timber came into use, which lasted six or seven times longer than the average period of their present duration; of these, to prevent the annoyance of long catalogues, it may be sufficient to mention the Royal William, which was launched in 1719, and never repaired until 1757; was surveyed afloat in 1785, and probably lasted many years more; and the

* The alarming prevalence of dry rot, especially in the timbers of ships, gives to every intelligent inquiry upon this subject, a very high degree of interest. At present we neither know the cause nor the cure of this premature decay in timber, opinions upon the subject being almost as numerous as the writers; and certain it is, that the preventives which have been proposed were formerly unnecessary, in the same kinds of timber; and we confess that we are much more favourably disposed to the opinion that the place in which the fires were formerly made on board of vessels, had a favourable influence in preserving them, than that the disease has been produced by the substitution of foreign for the indigenous oak of Great Britain. [Editor.

famous ship, Betsy Cains, the yacht in which King William performed his first voyage to England, that appears to have been then several years old, which was sold to a merchant in the reign of George I. and employed in the coal trade, in which service she existed till February, 1827, when she struck on a reef of rocks near Tynemouth bar, and was there lost only for want of timely assistance, her timbers being then perfectly sound.

The species of oak that is indigenous to the British isles, is the Quercus Robor, which produces a close grained solid timber, rarely affected by rot of any kind. The leaves of this species are short, deeply indented, and of a dark green colour; and its acorns grow singly, or at most two together, on long stalks, while its bark is somewhat rough.

The other species, from whence so much mischief has been supposed to arise, is the Quercus Sessiflora, the leaves of which are long, rather serrated at the edges than indented, of a yellow green on the upper side, and a whitish green on the under, and set on short stalks, about half an inch in length, with acorns growing in clusters, close to the twig, or very nearly so, and having its bark of a lighter colour and smoother texture than the native oak; the timber of this tree is much less solid, and more spongy. This species is also called the Durmast and the Norwood oak, and probably by several other local appellations.

This description of the different trees is given, from a conviction, that while the first should be cultivated as our national timber, almost as emblematic of Britain, as the palm was anciently of Judea, the other kind, with the many names, should be either extirpated as a noxious weed, or at least be only employed in domestic uses; while all planters should be enjoined from its propagation, if not prevented by actual penalties.

Another circumstance merits attention, as not unlikely to influence the duration of oak timber, in which there is a marked difference between what sprung up in old times, and that produced in the last century. In those remote ages the woods were wild, the oak grew where the acorn dropped, and was never without its tap root descending to great depths in the soil, and extracting nourishment from it at times when the more superficial roots were nearly inert for want of moisture; this, by itself, is sufficient to produce timber of a superior quality to that of modern times, when young oaks are transplanted with as much indifference as cabbage plants, which of course totally destroys the tap root, and more or less, on this account, deteriorates the timber.

It is also highly probable that the locality and management of the fires for cooking in ships in old times, materially contributed to secure them from the devastations of the dry rot. In the reign of Queen Elizabeth the cook room was made below in the waste or hold of the ship, and when Sir Walter Raleigh wrote his Essay on Shipping, published in 1650, the practice of making it in the forecastle had only commenced in merchant vessels, and had not been introduced into the navy. It is true that Sir Walter states many incon-

veniencies to arise from the old location, and much recommends that commenced by the merchants; but it is also no less certain that a fire being maintained constantly in the hold of the ship must have banished from it damps and stagnant air, without both of which the dry rot is never known to exist; and by the dryness and ventilation that it produced, must at the same time have materially contributed to the health of the seamen, who even at the present day too often suffer from typhus fever, produced by noxious air generated in the hold, and confined until it becomes more highly pestilential than in any other known instances, as has been well explained by Dr. Maccullogh in his Treatise on Malaria; and although, perhaps, it might not be adviseable to restore the ancient location of the cook room, as it would in all probability be in vain to attempt this change, even should the means of preventing all the inconveniencies pointed out from it by Sir Walter be presented; yet as a fire in the hold has been found to have produced such beneficial effects, it certainly would be most advantageous to again have one in that part of the ship; the fire place for which might be so managed as to occupy but little space (since no cook room need be added) more especially as the flue from it might be brought up through the pump well; and being enclosed by an iron case, and brought high above deck, like the chimneys of steam-ships, would cause no risk from fire, or any other inconvenience; while, in addition to the practice of passing water through the hold every day, by means of cocks and the pumps, (recommended by the Doctor, and employed by some naval captains with the best results), it would both prevent destructive sickness, and materially increase the duration of the ship, by removing completely the most potent sources from whence the dry rot originates.

A cause of dry rot has been assumed by a writer in the Westminster Review for April, 1829, to be a vegetable of the fungus species, that works its way in the body of the wood *without producing any external appearance;* but it is so contrary to the course of nature, that any plant could exist without organs, analogous at least to leaves, for acting on the air chemically, that we may well be excused for doubting the fact, at least till it is most unequivocally proved; and although the trufle seems to be a plant of this nature, and to countenance the opinion, yet it has so often happened, that supposed anomalies in nature have disappeared before more accurate investigation, that even in this instance the same doubt may be retained with the strictest propriety: and even if it were proved, that some such undermining hidden agent existed for the destruction of timber, independent of the known sources of putrefaction; the effect would be so much more similar to the known operation of certain minute insects, that the best proofs must be produced that these are not the cause, before assent should be given to an origin of it, subversive of a law of nature that seems to be universal. Dry rot has also been attributed often before to a fungus growing openly in the usual manner; but as common rot has either always been known to exist previously to the appearance of this fungus, or the causes of it at least to be in powerful activity on such occasions, this latter plant

must be considered as a secondary assistant and accelerator, instead of a primary cause.

Mr. George, who has lately obtained a patent for the prevention of the dry rot, has also lately promulgated a new origin for the dry rot, in attributing it to the effect of the variations of temperature transmitted through the wood; but we imagine other causes for putrefaction existed amply in the locality of his cellar (the rapid decay of the door of which led him to form this novel opinion), besides those that he has mentioned, as it is not twenty yards from the Rolls Chapel, which was and is still a public place of worship; and as such places were accompanied by cemeteries until very lately, and as some monuments still remain in the chapel, there is the highest probability that a burying-ground existed and extended beyond Mr. George's cellar, and that this is actually surrounded by the remains of the deceased of former times—the effect of which on the air of the place is alone sufficient to rot not only the door, but every other matter capable of decay placed within its influence, without seeking for any remote or fanciful causes.

Mr. Langton, who obtained a patent for seasoning or drying timber in August, 1825, has, in his remarks on it, recommended his method as a means of preventing the dry rot in ships; but, as his process extracts nothing but water from the timber, and leaves its mucilaginous parts unaltered, when it is exposed again to wet or damp, as must occur in all vessels at sea, the attraction of these substances for water, and their effect in accelerating the rot in the fibrous parts of the timber from this circumstance, must soon render ships built with dried timber as liable to this evil as they were before. (See p. 156, vol. 2, for 1826.)

Mr. Newmarch's patent of February, 1826, professes also to prevent the dry rot, by boiling the timber in oil, mixed with substances that are not very adviseable for the purpose. This method, however, has the advantage over the last in producing permanent effects, as it is certain that timber so prepared would not be liable to attract moisture as before, while most of what it held originally would be driven out effectually by this process; but if tallow were substituted for oil, and sulphur for the other ingredients, the plan would be more likely to have the effect intended, since the tallow would be retained in the capillary tubes of the timber on cooling, instead of running out again, as most of the oil would; and the sulphur would readily dissolve in this, while the salts would not in the oil, with which they are directed to be mixed by the specification of this patent. (See p. 304, vol. 2, for 1826.)

And here the opinion of the Westminster Reviewer, that all attempts to prevent dry rot, by previous preparation of the timber, are mere quackery, must be reprehended, as at least very unphilosophical and hasty, as well as his sneers against the late Sir Humphrey Davy for something of this nature, that he asserts was proposed by this eminent chemist. It is not very long since chemistry has began to be much applied beyond the limits of medicine; and no man can fairly aver that it cannot effect this purpose, as well as

many others of great utility, in which it has succeeded most completely. In fact, Mr. Newmarch's method may be considered as chemical; and had he been better acquainted with this science, he would doubtless have made it more efficacious. Experiments, however, for preventing the dry rot in ships, require to be executed on a scale that very few individuals have the means of executing; and as they must therefore be tried either by departments of government, (the minds of the chiefs of which are probably too fully engaged with other matters to attend to affairs of this nature), or else by joint companies, it is no wonder that no certain remedy for this evil has yet been indisputably ascertained.

But chance, which often gives valuable information to observers, has pointed out a preventive of the rot in timber, that while it promises to be efficacious, has at the same time cheapness to recommend its employment. It has been found that the timber used about the copperas works at Whitstable, in Kent, has continued in a sound state for very many years, which the seafaring people of that place attribute to its being soaked in the liquor that runs from the copperas stones, and are unanimous in thinking this would prove a complete preventive of dry rot; there is the greater reason to hope for a good effect from this, as the copperas liquor, by its sulphuric acid, has a decided action on every part of timber, somewhat analogous to that which charring has on its surface, by which it has been long known to be preserved, where it would otherwise have decayed rapidly.

That there should be two species of rot, as urged very dogmatically by the Westminster Reviewer, is not to be admitted without proofs of the most incontrovertible nature, more especially as the dry rot may be accounted for, as to its peculiarities, from circumstances solely accidental to the timber, and depending on the same conditions of temperature and moisture as the common rot.

That the rot in timber does not take place, if it be thoroughly dried, and kept afterwards from wet, is too well known to require proof; and, on the contrary, there are many instances of its being preserved sound for centuries when entirely immersed in water. It therefore seems necessary, to produce rottenness, that the degree of moisture in it should not be such as will prevent the entrance of air into its pores or minute tubes, while any portion of it under this quantity accelerates the process, and some is absolutely necessary; the water seems on this occasion to be decomposed, and its oxygen to combine with part of the carbon of the wood to form carbonic acid, while its hydrogen becomes united to another portion to produce carbonated hydrogen; and as mucilaginous substances have great attraction for water, that timber which contains most of them, or which, in other words, retains most sap, will be most liable to rot, while at the same time the parts of the same timber, that are kept dry, will still remain sound. Now as dry rot takes place in the internal parts of timber, while the outside exhibits often no appearance of decay, it is only necessary for this effect that the outside of it should be kept dry, while the inside retains that portion of

moisture that produces rottenness; and in this state, in every species of building, all timber must be, that still retains sap, or has not been deprived of its natural moisture, and is not too solid to admit moisture again; or, what comes to the same result, is sufficiently spongy and open to admit moisture, and is possessed of mucilage for its retention. Putridity then commencing in the internal part of such timber (while the outside remains sound from the dryness caused by its exposure to the air,) the minute seeds of fungus, which seem to penetrate every where, begin to send out roots, as all seeds will beneath a soil fit for them, but do not complete the plants until the stalks reach the surface. The roots so produced may, and probably do, on decaying, increase the tendency to rottenness in the timber; but that the whole plant of each fungus grows entirely in the centre of timber perfectly sound, as asserted by the Reviewer, and causes it then to rot, is, as before noticed, so contrary to all those processes of nature, that are exposed to view, as to be totally incredible.

The preceding methods of preventing the dry rot in ships, independent of the species of timber used, may be classed into those that are applicable after the vessel is constructed, and those to be employed for the previous preparation of the timber; of the latter, Mr. Newmarch's process, and that by copperas liquor, which may be called the Whitstable discovery, are the best; but this last is much the cheapest; and it is only necessary to add respecting it, that if the timber be artificially dried, before it be immersed in the liquor, either by exposing it in stoves, or in an apparatus similar to Mr. Langton's, it will imbibe the solution much more completely and rapidly. The choice of the timber of which a ship is to be built, is however, as before explained, of the greatest importance with this view; and none of the Quercus Sessiflora should ever be employed in any part of its frame.

The first class of preventive means, comprised in the daily washing out of the hold, and in keeping a fire constantly in it in a fire-place properly formed and arranged, would be very beneficial, both for the prevention of rot, and the preservation of the health of the seamen, as has been observed; but as the action of the latter method particularly, and of the former in a great measure, would be much promoted by the entire absence of inside planks or ceiling, as it is technically called, it may be proper to state here, that a perfectly safe method of building ships without inside planks, is described in the last mode of constructing them, recounted in that specification of Mr. J. W. Boswell's patent for building ships, from which Sir Robert Seppings has borrowed so very largely on several occasions, without any acknowledgment. B.*

[*Repertory of Patent Inventions.*

* Does not the last remark render it probable that the signature B. is the initial of Boswell?

On the Manufacture of French Articles of Perfumery.

[Concluded from page 302.]

LIQUID ALMOND PASTES.

These pastes are esteemed, on account of the advantage they possess, of being used without water. Such are those of the rose, orange, vanille, and *bouquet*.

The honey paste, is, however, justly preferred; and is prepared in the following manner:—

6 pounds of honey.
6 pounds of paste of bitter almonds.
12 pounds of the oil of ditto.
26 yolks of eggs.

The honey must be boiled separately, and strained; we then add the six pounds of almond paste, and knead them together; and finish the operation, by adding gradually and alternately, the quantities of yolks of eggs, and oil of bitter almonds, indicated.

ROUGE.

We put into linen bags *carthamus* or *safflower*, and place them under a stream of running water, taking care to beat them strongly all the while; by this means we are enabled to separate the red from the yellow colouring matter of the carthamus; we continue this treatment until the water ceases to be any longer coloured. The tint of the material will then have completely changed its appearance, and have become of a fine red; we then treat it in the cold, with a solution of potash, at four degrees, for twelve hours, and decant it. We then take the nearly exhausted residuum, and treat it anew in the same manner, but by a solution of potash marking only two degrees. All the liquids being then united, we pour in by degrees, the juice of citrons, to a perfect saturation: the red colouring matter will then gradually precipitate; containing, however, some portion of the yellow; we completely free it from this, by plunging it into a piece of cotton cloth, which completely separates the two colouring matters; but on treating it anew with potash, the red colouring matter alone will dissolve, and the yellow remain adhering to the cloth. It is then sufficient to again saturate the alkaline liquor with citron juice, and the red colour of the carthamus precipitates; this is afterwards mixed with prepared talc, and sold under the name of *fard rouge*.

WHITE.

The pearl white is procured by dissolving bismuth, previously freed from arsenic, in nitric acid, diluted with one-third its weight of water; it is better that the nitric acid should be perfectly pure, and the solution limpid. Often, however, this appearance will not present itself, as there is generally formed an arseniate of bismuth but little soluble; in this case we must decant it, and pour into the solution a great quantity of water, and until the precipitate forms more abundantly. This precipitate must be frequently washed to free it from an excess of nitric acid; this done, and if it has been well pre-

pared, it will be of a brilliant whiteness, and in small micaceous scales.

ROSE, ORANGE-FLOWER, AND VANILLE PASTILS.

Rose Pastils.

12 ounces of gum arabic.
12 ounces of olibanum, in tears.
12 ounces of storax, ditto.
8 ounces of nitre.
16 ounces of powder of white roses.
3 pounds fourteen ounces of charcoal powder.
1 ounce of essence of roses.

Orange-flower Pastils.

12 ounces of gum galbanum.
12 ounces of olibanum, in tears.
12 ounces of storax, in tears.
8 ounces of nitre.
3 pounds fourteen ounces of charcoal powder.
1 ounce of superfine neroli.

Vanille Pastils.

12 ounces of gum galbanum.
12 ounces of olibanum, in tears.
12 ounces of storax, ditto.
8 ounces of nitre
8 ounces of cloves.
16 ounces of powder of pure vanille.
3 pounds fourteen ounces of charcoal powder.
4 *gros* of essence of cloves.
8 ounces of essence of vanille, first infusion.

We must thicken each of these mixtures with two ounces of gum tragacanth, dissolved in two pints of rose water. It is necessary to add, that all the materials must be reduced into the state of an impalpable powder.

The making of pastils naturally leads us to describe *le parfum des rois.* Some drops of this liquor being burnt in an apartment diffuses a most agreeable odour; it may be made either by infusion or distillation:

8 *litres* of spirit, at three-sixths.
1 pound of gum benzoin.
1 pound of storax.
8 ounces of aloes wood.
1 *litre* of spirit of roses, first infusion.
1 *litre* of spirit of orange-flowers, first infusion.
8 ounces of essence of amber, ditto.
8 ounces of essence of musk, ditto.
1 pound of essence of vanille, ditto.

Our ladies also use the *odoriferous cassolettes,* which they constantly

carry about them to balls and public spectacles. The paste which forms them is thus prepared:

8 pounds of black amber.
4 pounds of rose powder.
2 ounces of gum benzoin.
1 ounce of essence of roses.
1 ounce of gum tragacanth.
Some drops of oil of sandal wood.

We must first pulverize all these substances, add the liquids, and form them into a paste with the gum tragacanth.

ESSENCES.

We shall now enumerate the essences most generally employed in perfumery.

Essence of roses.
Essence of neroli.
Essence of cloves.
Essence of *petit-grain.*
Essence of bergamot.
Essence of zest of citrons.
Essence of distilled citrons.
Essence of thyme.
Essence of rosemary.
Essence of myrrh.
Essence of *bizarrade.*
Essence of citron.
Essence of Portugal.
Essence of amber.
Essence of musk.
Essence of vanille.
Essence of lavender.
Essence of cinnamon.
Essence of *limette.*
Essence of English mint.

Unfortunately, we seldom find these essences in commerce unadulterated. We may mention, for instance, those of *bergamot* and citron, in which we constantly find a greater or lesser quantity of the essence of Portugal; sometimes we find them still more grossly falsified, by adding variable quantities of oil or spirit. We have no certain means of detecting the falsification; nor have the experiments made with this view hitherto been sufficiently satisfactory.

ESSENCES MADE BY INFUSION.

Essence of Musk.

5 ounces of musk cut into small morsels.
1 ounce of civet.
4 *litres* of spirit of *ambrette.*

We put the whole into a matras, and expose it to the heat of the sun for the space of two months, choosing the hottest months in preference. But if the preparation be made in winter, we must employ a water bath.

Essence of Vanille.

3 pounds of vanille, in branches, of the first quality; these must be cut into small morsels;
4 *litres* of spirit of *ambrette.*
2 *gros* of cloves.
4 *gros* of cinnamon.
Half a *gros* of musk.

Pursue the same method as for the essence of musk.

Essence of Amber.

4 ounces of amber-gris.
2 ounces of musk.
4 pints of spirit of *ambrette.*

To be treated also in like manner.

Essence of Rhodes.

This essence has been used for these twelve or fifteen years past, but much more commonly lately; it is, indeed, imperfectly replaced by the essence of roses of Constantinople and France; the latter being now worth 100 francs the ounce; whereas, formerly, we could hardly obtain forty-five francs for that of the first quality. Many perfumers also employ it to mix with the essence of roses, as it communicates to the latter a strength which it does not ordinarily possess. It is, particularly, the scientific perfumers, who perceive this advantage.

Esprit d'Ambrette.

They take twenty-five pounds of *ambrette*, which they distil with twenty-five *litres* of spirit of three-sixths; to which they also add six pints of water, and draw off twenty-five *litres*. The spirit of *ambrette* employed in the preparation of the essence of vanille is thus made.

Perfumed Bags.

These are formed of cotton cloth, filled with odoriferous powders, and afterwards covered with taffety, the colour of which varies according to the taste of the wearer.

At Montpelier the powders are replaced by the odoriferous plants; such as thyme, wild-thyme, and rosemary.

Powder of Carnations.

3 pounds of Provence rose leaves.
3 pounds of iris-leaves.
6 ounces of cloves.
1 pound four ounces of *bergamot* rind.
1 pound eight ounces of grains of *ambrette.*
6 ounces of cinnamon.
6 ounces of long cyprus.
1 pound ten ounces of pale rose leaves.
8 ounces of dry *rassies.*
8 ounces of orange-flowers.
8 ounces of the leaves of carnations.

We must mix the whole together, and powder and sift it as fine as possible.

Powder of Musk Roses.

6 pounds of pale rose leaves.
1 pound of cyprus powder.
1 *gros* of essence of roses.

Follow the same process as for the preceding powder; but observe, that the essence of roses is not to be added, until the powder has been made and sifted.

POMMADE GLOVES.

Every one knows that these gloves are used for softening and refreshing the skin. They are prepared with a *pommade à fleurs*, to which is added a little white wax. As the odour of the rose is the sweetest, this is generally employed in preference.

VINEGARS FOR THE TOILETTE.

These are always made by distillation, and of whatever odour may be required to be communicated to them.

Rose Vinegar.

60 pints of natural vinegar, of the first quality.
4 pounds of dried pale rose leaves.
Distil the whole and draw off thirty pints.

Thyme Vinegar.

60 pints of natural vinegar.
4 pounds of thyme flowers.
Distil, and also draw off thirty pints.

To give a more agreeable perfume to this vinegar, thirty pints of rose vinegar may be added to it.

We may also follow the same process to form the following vinegars, viz.

Rosemary,	Cloves,
Marjorum,	Laurel,
Wormwood,	Wild-thyme,
Angelica,	Lavender,
Savory,	Citron,
Balm,	Orange-flower,
Cinnamon,	*Des sultanes.*

We can also prepare vinegars for the toilette of other odours; such as those of vanille, carnation, jasmine, tube rose, and others. These last, for example, are prepared by distillation, by adding extracts of strong odours.

Amongst the various kinds of vinegars employed to expel bad air, we shall indicate that which has been long known, under the name of *vinegar of the four thieves.*

200 pints of vinegar of the best quality.
One and a half pounds of dried rosemary.
One and a half pounds of dried sage.
One and a half pounds of dried mint.
One and a half pounds of dried rue.
One and a half pounds of lavender flowers.
One and a half pounds of *calamus.*

One and a half pounds of cinnamon.
One and a half pounds of garlic.
12 pounds of the greater wormwood.
12 pounds of the lesser ditto.

We distil off these 200 pints of vinegar, from the materials, not bruised; and then pour it upon another equal quantity of the materials, completely pulverized. After suffering them to infuse the necessary time for the impregnating of the vinegar, we distil off twenty-five pints, in which we dissolve, in the cold, one pound of camphor, and then add to the solution twenty-five cloves. This last material is intended to communicate the desired colour to it. The whole is then suffered to remain at rest till the process is finished. The residuum of this operation will serve to prepare a new quantity of vinegar, equal to the first.

There are also many vinegars possessed of other properties—such as vinegar for the stings of gnats; Seville vinegar, for moistening tobacco; vinegar of squills, for the voice; dentifrice vinegar, and Roman vinegar, for the teeth; vinegar of Flora, to abate the heat of the skin; *vinaigre spectique*, for freckles; and lastly, dissolvent vinegar, for corns on the feet.

VINEGAR DE ROUGE.

Many persons prefer this to the *rouge* in pots, or in powder, on account of the facility in using it, which it affords.

Composition of Vinaigre de Rouge.

8 ounces of carmine, of the best quality.
4 ounces of cochineal, in powder.

These ingredients are to be boiled in twelve pints of rose water, and eight pints of spirit of roses; and their colour developed with two ounces of cream of tartar, and one ounce of alum. The liquid of this first operation constitutes the first shade; the second shade is obtained with the residuum, by again adding the same quantities of rose water and spirit of roses to it.

The residuum of the second shade again serves to make a third, by adding similar quantities of rose water and spirit of roses to it.

We regret that it is not in our power to afford longer details of an art, which, in many respects, possesses an interest sufficiently important; nevertheless, what we have given, will be sufficient to enable any one to conceive the progress of every particular of this manufacture. And we may remark, that the art is yet but in its infancy. In fact, it is every day profiting, from the discoveries which the physical sciences add to the processes of manufactures.

EDWARD LANGIER.

Experiments on the Friction and Abrasion of the Surfaces of Solids. By George Rennie, Esq. F. R. S.

From the Transactions of the Royal Society.

Continued from page 295.

The apparatus employed in performing the experiments on the friction of attrition consists simply of a strong table accurately made and adjusted, and provided with a platform capable of being elevated to any angle within thirty degrees, as shown by the graduated arc.* The substances tried were placed on the platform and in the sliding block above, to which the scale and weights for bringing the substances into closer contact were suspended: a cord going over a pulley was attached to the sliding block, which received its motion from weights put into the moving scale. The different phænomena were then accurately recorded, as appears by the accompanying Tables, and the conclusions derived from them.

Table I.—*Experiments on the Friction of 3 square inches surface with cloth.*

Weight on surface.	Weight required to move it.		Proportion.	
Black Single Kerseymere. No. 1.				
lbs.	lbs.	oz.		
1	1	6		
2	2	4		
5	4	2	1	21
10	6	4	1	60
20	9	13	2	03
28	13	2	2	13
56	20	11	2	70
Superfine Blue. No. 2.				
lbs.	lbs.	oz.		
1	1	3		
2	2	12		
5	5	3		
10	8	4	1	21
20	12	11	1	57
28	15	5	1	82
56	22	11	2	47

* An engraving of this apparatus will be hereafter given.

Experiments on the Friction of 3 *square inches surface with Cloth.*

Weight on surface.	Weight required to move it.			Proportion.	
Drab Milled Kerseymere. No. 3.					
lbs.		lbs.	oz.		
1		1	11		
2		2	11		
5		5	3		
10	took 2¼ lbs. in addition to start it	7	13	1	28
10	after remaining 12 hours it took to start it	12	10		
20		12	11	1	57
28		16	7	1	70
56		25	3	2	22
Drab Kersey Hunter. No. 4.					
lbs.		lbs.	oz.		
1		1	5		
2		1	15	1	03
5		3	8	1	43
10		5	4	1	90
20		8	11	2	30
28		10	0	2	80
56		19	3	2	92
Strong Drab. No. 5.					
lbs.		lbs.	oz.		
1		0	15	1	06
2		1	8	1	33
5		3	2	1	60
10		4	11	2	13
20		7	11	2	60
28		9	12	2	87
56		17	14	3	13

Remarks.

1. That with fibrous substances, such as cloth, friction diminishes with an increase of weight.

~~2. That friction is greater (cæteris paribus) with fine cloths than~~ with coarse cloths.

3. That friction is greatly increased by time.

4. That friction varies from one-third to an amount greater than the total weight.

TABLE II.—*Experiments on the Velocities with Drab Milled Kerseymere, No. 3.*

Wt. on surface.	Weight required to move it	Total space passed over.	Time in seconds.	Remarks.
Of 9 square inches surface.				
lbs.	lbs. oz.	inches.		
1	1 8	24	45	From 1 lb. to 2 lbs. the adhesion is greater than the weight on surface.
			32	
			30	
			22	
			23	Velocities very irregular.
1	1 5		24	
			25	
			40	
			37	
2	2 5		31	Velocities very irregular.
		half way in 17 sec. the whole in	26	
			17 27	
2	2 5		21 30*	* Denote the experiments that approximate the nearest to a uniform velocity.
			33 53	
			17 30*	
5	4 3		29 45	Results very irregular, owing perhaps to the fibres of the cloth having been previously compressed.
10	6 7	mean of 3 trials	45 63	
20	9 7		30 50	
Of 18 square inches surface.				
lbs.	lbs. oz.	inches.	1st half. 2nd half.	
20	13 6	mean of 3 trials. 21	23 33	Increase of surface shows an increase of resistance with equal wts. of 20 lbs.
20	after remaining 14 hours it took to start it 23 3			Time nearly doubles the resistance.
Of 27 square inches surface.				
lbs.	lbs. oz.	inches.	1st half. 2nd half.	
1	2 8	mean of 3 trials 18	4 14	Three times the surface nearly three times the resistance.——Velocities irregular. Vide Vince's Experiments.
2	3 10		30 73	
5	6 7		25 60	
10	10 2		28 55	Nearly uniform.

1. From the foregoing experiments it appears that velocities observe no particular law, except in three instances, where the last halves of the space passed over approximate to the first halves.

2. That increase of surface very much increases the resistance.

TABLE III.—*On the Friction with Cloth at different angles of elevation.*

Weight on surface.	Moved at degrees.	Space passed over.	Time in seconds.	Proportion.
Of 3 square inches.				
lbs.	°	inches.		
10	37.00	24	55	1.327
20	28.20		55	1.855
28	26.00		47	2.051
56	20.45		44	2.640
Of 27 square inches.				
lbs. oz.	°	inches.		
13 8	45.00	18	32	1.000
20 0	40.30		42	1.171
28 0	35.45		32	1.389
56 0	26.00		28	2.052

1. In comparing the results given by the angles of repose with the results given by the horizontal surfaces on similar kinds of cloth, there is a slight variation.

2. The second series of experiments afford no measure of comparison, from the inadequacy of the weights of 10 lbs. being unable to give motion to the upper surface, 13 lbs. 8 oz. gives an approximation.

3. The less the weight, the greater the angle of repose.

4. Increase of surface produces a very great increase in the angles of repose.

. The times very variable, diminish with increase of weight.

. Velocities likewise variable.

TABLE IV.—*On the Friction of different Woods two square inches surface.*

Weight on surface.	Weight required to move it.		Proportion.	Weight per square inch.		Average.
Red Teak on Red Teak.						
cwt.	lbs.	oz.		cwt.	qrs.	
½	6	14	8.14	0	1	
1	14	2	7.92	0	2	
2	23	3	9.66	1	0	
3	38	1	8.82	1	2	
4	52	3	8.58	2	0	
5	64	2	8.73	2	2	
6	71	12	9.36	3	0	8.82
7	84	3	9.31	3	2	
8	90	8	9.90	4	0	
9	120	11	8.35	4	2	
10	126	5	8.86	5	0	
11	141	15	8.67	5	2	
12	154	3	8.71	6	0	
13	170	10	8.53	6	2	

Experiments on the Friction of different Woods two square inches surface.

Weight on surface.	Weight required to move it.		Proportion.	Weight per square inch.		Average.
American Live Oak on American Live Oak.						
cwt.	lbs.	oz.		cwt.	qrs.	
½	7	15	7.05	0	1	
1	14	13	7.56	0	2	
2	25	15	8.63	1	0	
3	36	11	9.15	1	2	
4	55	11	8.04	2	0	
5	70	3	7.97	2	2	
6	86	3	7.79	3	0	7.65
7	109	7	7.16	3	2	
8	128	4	6.98	4	0	
9	140	3	7.19	4	2	
10	154	1	7.26	5	0	
11	162	14	7.56	5	2	
12	187	5	7.17	6	0	
Pine on Pine.						
cwt.	lbs.	oz.		cwt.	qrs.	
½	16	3	3.33	0	1	
1	27	14	4.01	0	2	3.40
2	68	4	3.27	1	0	
3	111	5	3.01	1	2	
Black Beech on Black Beech.						
cwt.	lbs.	oz.		cwt.	qrs.	
½	8	6	6.68	0	1	
1	15	5	7.31	0	2	
2	28	0	8.00	1	0	
3	45	3	7.43	1	2	
4	69	7	6.45	2	0	
5	83	3	6.73	2	2	7.13
6	100	4	6.70	3	0	
7	115	11	6.77	3	2	
8	124	10	7.18	4	0	
9	132	3	7.62	4	2	
10	148	11	7.53	5	0	
Norway Oak on Norway Oak.						
cwt.	lbs.	oz.		cwt.	qrs.	
½	8	3	6.83	0	1	
1	14	5	7.82	0	2	
2	26	4	8.53	1	0	
3	41	3	8.17	1	2	
4	56	7	7.93	2	0	7.67
5	67	3	8.33	2	2	
6	80	4	8.37	3	0	
7	102	0	7.68	3	2	
8	164	3	5.45	4	0	

Experiments on the Friction of different Woods two square inches surface.

Weight on surface.	Weight required to move it.		Proportion.	Weight per square inch.		Average.
English Oak on English Oak.						
cwt.	lbs.	oz.		cwt.	qrs.	
½	7	0	8.00	0	1	
1	15	0	7.46	0	2	
2	29	3	7.67	1	0	
3	43	2	7.79	1	2	7.83
4	55	0	8.14	2	0	
5	70	3	7.97	2	2	
Hornbeam on Hornbeam.						
cwt.	lbs.	oz.		cwt.	qrs.	
½	8	10	6.49	0	1	
1	16	3	6.91	0	2	
2	30	5	7.38	1	0	
3	46	11	7.19	1	2	
4	65	5	6.85	2	0	6.57
5	83	1	6.74	2	2	
6	105	2	6.39	3	0	
7	167	3	4.68	3	2	
Elm on Elm.						
cwt.	lbs.	oz.		cwt.	qrs.	
½	10	0	5.60	0	1	
1	22	1	5.07	0	2	
2	35	5	6.34	1	0	
3	53	2	6.32	1	2	
4	72	3	6.20	2	0	5.86
5	87	11	6.38	2	2	
6	108	4	6.20	3	0	
7	145	3	5.39	3	2	
8	168	11	5.31	4	0	
Honduras Mahogany on Honduras Mahogany.						
cwt.	lbs.	oz.		cwt.	qrs.	
½	12	7	4.50	0	1	
1	26	0	4.30	0	2	
2	39	3	5.71	1	0	
3	59	5	5.66	1	2	
4	74	7	6.01	2	0	
5	92	3	6.07	2	2	5.96
6	107	6	6.25	3	0	
7	118	2	6.63	3	2	
8	136	4	6.57	4	0	
9	154	1	6.54	4	2	
10	171	0	6.54	5	0	
11	182	3	6.76	5	2	

Experiments on the Friction of different Woods two square inches surface.

Weight on surface.	Weight required to move it.		Proportion.	Weight per square inch.		Average.
Yellow Deal on Yellow Deal.						
cwt.	lbs.	oz.		cwt.	qrs.	
½	19	7	2.88	0	1	
1	37	9	2.98	0	2	
2	76	3	2.94	1	0	2.88
3	113	0	2.97	1	2	
4	147	13	3.03	2	0	
5	224	0	2.50	2	2	
White Deal on White Deal.						
cwt.	lbs.	oz.		cwt.	qrs.	
½	18	12	2.98	0	1	
1	29	5	3.82	0	2	3.81
2	48	3	4.94	1	0	

TABLE V.—*Experiments on the Friction of two square inches surface of Wood at different angles of elevation.*

Wt. on surface.	Moved at degrees.	Time in descending 11 in.	Proportion.	Wt. on surface.	Moved at degrees.	Time in descending 11 in.	Proportion.
Red Teak on Red Teak.				**English Oak on English Oak.**			
lbs.	° ′	sec.		lbs.	° ′	sec.	
10	8 00	18	7.116	10	9 30	17	5.976
20	7 45	15	7.348	20	8 30	17	6.691
28	7 15	20	7.861	28	7 40	18	7.429
56	7 00	16	8.144	56	7 30	20	7.596
Amer. Live Oak on Red Teak.				**Elm on Elm.**			
lbs.	° ′	sec.		lbs.	° ′	sec.	
10	9 00	22	6.314	10	11 40	19	4.843
20	8 00	24	7.116	20	10 30	18	5.396
28	8 30	20	6.691	28	10 00	19	5.671
56	7 45	25	7.348	56	9 30	19	5.976
Black Beech on Black Beech.				**Hornbeam on Hornbeam.**			
lbs.	° ′	sec.		lbs.	° ′	sec.	
10	8 15	20	6.897	10	10 00	20	5.671
20	7 20	17	7.770	20	9 15	21	6.140
28	7 40	19	7.429	28	8 30	20	6.691
56	6 40	21	8.556	56	8 15	19	6.897
Norway Oak on Norway Oak.				**Honds. Mahog. on Hornbeam.**			
lbs.	° ′	sec.		lbs.	° ′	sec.	
10	8 00	19	7.116	10	12 00	22	4.705
20	7 30	20	7.596	20	12 30	21	4.511
28	7 00	20	8.144	28	11 45	21	4.808
56	6 20	25	9.010	56	11 20	23	4.990

Experiments on the Friction of two square inches surface of Wood at different angles of elevation.

Weight on surface.	Moved at degrees.	Time in descending 11 inches.	Proportion.
Yellow Deal on Yellow Deal.			
lbs.	° ′	sec.	
10	15 00	10	3.732
20	17 00	9	3.271
White Deal on White Deal.			
lbs.	° ′	sec.	
10	18 00	10	3.078
20	12 30	11	4.511
Pine on Pine.			
lbs.	° ′	sec.	
10	16 00	14	3.488
20	17 00	11	3.271

Remarks.

From the foregoing experiments it appears that there is a great deal of irregularity in the results.

Increase of pressure scarcely increasing the resistance. This may arise in some degree from the surfaces becoming condensed, and thus rendered less liable to abrasion. In some of the cases abrasion had already commenced, but it was not convenient to pursue the experiment further.

The soft woods present more resistance than the hard woods.

Yellow deal on yellow deal being the greatest,

Red teak on red teak the least.

According to Mr. Knowles of the Navy Office, F. R. S., the weight of the Prince Regent of 120 guns on the slips previous to launching, was 2400 tons; which, divided by the area of the sliding surface of her bilge-ways (equal to 149,184 square inches), gives a pressure of 36 lbs. per square inch.

But the weight of the Salisbury of 58 guns on the slips, according to the area of her bilge-ways, was 44 lbs. per square inch. Now, by the foregoing Table, the average force required to put in motion the three different kinds of oak, under a pressure of 56 lbs. per inch, is about one-eighth of the pressure, which proportion prevails even as high as 6 cwt. per inch area; and by Table IX. we find that soft soap (the ingredient mostly used for diminishing the friction of bilge-ways under a pressure of 56 lbs. per inch,) gives about $\frac{1}{38}$th of the pressure for the friction. Hence the angle at which a building slip should be laid can be easily determined. Coulomb even makes 49 lbs. per square inch, and $\frac{1}{27}$th for the pressure for hogs-lard.

The weight of the middle arch (of 151 feet 9 inches span) of the New London Bridge, together with the centres, is 4900 tons. This

acting upon the surface of the striking wedges equal to 540 square feet, gives a pressure of 140 lbs. per square inch. The angles of inclination of the wedges are equal to 80° 45′, and their surfaces are covered with sheets of copper well coated with tallow. On removing the check pieces, the wedges commenced gliding back slowly and uniformly, by the gravity of the arch and centres, and the motion was checked and continued until the arch was left in equilibrio.

[TO BE CONTINUED.]

On the Artificial Production of Cold. By RICHARD WALKER, Esq. *of Oxford, in England.*

To the Editor of the Philosophical Magazine and Annals.

GENTLEMEN,—It is now forty-one years since my discoveries on the "artificial production of cold" were first made public by their appearance in the Philosophical Transactions for the year 1787, and several succeeding volumes. Passing over what has already been published respecting them, I shall proceed to a detail of a few other circumstances as a kind of appendix, which I have for several seasons intended to offer for publication, had not other matters, as professional avocations and professional communications, too much engaged my attention to allow of it.

Immediately on the announcement of the discoveries as above stated, I received various proposals from respectable persons respecting their practical utility in this country. I answered these by a declaration, that wherever natural ice could be obtained and preserved, this must ever supersede the use of the artificial means alluded to. It is true that I had an eye to their application in hot climates, as between the tropics; and as soon as my experiments became public, a treatise on the diseases of tropical climates appeared from the pen of Dr. Moseley, who fixed upon one, which he considered the most appropriate, and strongly recommended its adoption as a very valuable acquisition, as well in a medicinal point of view, as a luxury.

Relinquishing, from various causes, the design of applying them myself to any such purpose, I took care, however, to point out, in my original communications, the complete efficiency of them for such intention to their utmost extent, and the best mode, as it appeared to me, of applying them in hot climates.

Understanding, a few summers ago, that a manufactory had been established for preparing ice creams, as well without the use of ice, as with it; and likewise for making for sale an apparatus for the purpose,—I was induced to visit it. I examined the apparatus,—a very appropriate one for the purpose, and likewise the freezing powder, which I instantly recognised to be the weakest in power of my various compositions for the purpose, but possessing the advantage of being readily recovered repeatedly for the same purpose with undiminished effect. This powder, by its taste and appearance, I found

to be a mixture of sal ammoniac and nitre, which I was informed was repeatedly recoverable in a fit state for refrigeration. I originally exerted every effort, in vain, to increase its power by the addition of a third ingredient, possessing likewise the advantage, merely by evaporation to dryness, of being repeatedly recovered for the same use. This powder, as related in my original communications, consists of equal parts by weight of sal ammoniac and nitre. By way of test, I recovered it by evaporation twelve times, without any abatement of its efficacy, as originally stated.

It is unnecessary to enter into a description of the apparatus just mentioned, or the principle and mode of its application, especially as the whole is embraced in the following statement.

A circumstance occurred here (at Oxford) which occasioned the method to be put to the test of useful application. A confectioner, happening in a scarce season to be unprovided with natural ice, applied to me for assistance. I assured him that in the large way (as I have stated in my original communications) the best method was to freeze water first, and then to use the ice in the usual way for freezing creams. Accordingly an apparatus of large dimensions, of rather an oblong form, was made of tin (fitter for the purpose if cased with wood) consisting of channels so constructed that the water to be frozen should be subjected to the freezing mixture on both sides. This, properly prepared, was placed in a cool cellar, during the night; and early in the morning (the temperature in the open air in the shade in the day time being above 80°) the ice was collected, which amounted to several pounds in weight. This ice, which was as limpid as the finest flint glass, was applied in the usual way, and with the apparatus ordinarily used by confectioners for the purpose of freezing creams, and the mixed powder, of which he had procured an adequate quantity, repeatedly recovered by evaporation over his hot iron plates, for fresh use.

I shall now present the immediate object of my present communication; viz. what I consider to be the best mode and fittest apparatus for cooling wine in summer, for freezing creams in the small way for private use, and likewise for freezing a small portion of water, merely as an experiment for public or private exhibition.

The drawing annexed (Plate IV,) is designed to represent, on a small scale, the construction and exact proportions of each freezing apparatus, and likewise the construction and form of the apparatus for cooling wine.

Fig. 1, is an apparatus for freezing water on the smallest scale, as above mentioned, in the hottest weather. The vessel for containing the freezing mixture is three inches and a half in width, and its height equal in measure to its width; and the tube for containing the water to be frozen five-eighths of an inch in width, and reaching, as represented, very near to the bottom of the vessel: there is likewise a rim or continuation of the vessel, without a bottom, to insulate it from the table or stand it rests upon. The apparatus itself consists of two parts; viz. the vessel for containing the freezing mixture, and its cover, in one piece with the tube, fitting close over it (repre-

sented together in the drawing.) When the water is frozen, upon taking off the cover and wiping the tube, the solid ice will have become detached by the heat, and on inverting it drop out.

The process may be known to be completed by the going off or melting of the hoar-frost, which exhibits a curious appearance outside the apparatus.

Fig. 2, consists of an apparatus in one piece; viz. the vessel for containing the cooling mixture, and the cup or can (if I may so call it) for receiving the decanter, its top rising somewhat above the height of the vessel for an obvious reason, with a cover that will admit of easy removal (in the drawing represented together.) This apparatus likewise has an appendage or rim like the former, to insulate it from the table:—it may be convenient to be possessed of a couple of these.

Fig. 3. The apparatus for freezing creams, in which the freezing mixture is to act on both surfaces of the part containing it, as being more economical and expeditious, is not so simple. This, however, consists only of two parts; viz. the vessel for containing the freezing mixture, and a cover, to which is attached, in the same piece (instead of a tube or cup as in Fig. 1,) a concentric annular cavity or chamber, in which the prepared cream is to be frozen: this cavity, forming a circle within the vessel itself, is open at the top, as represented, and of course closed at the bottom, and reaching very nearly (as the tube in Fig. 1,) to the bottom of the vessel: this secondary part, as likewise represented, fits close, as in Fig. 1, over the vessel containing the freezing mixture. The proportions of the apparatus when together, are thus: the outer space in width, two parts all round; the middle space, or that which contains the cream, one part all round; and the inner space three parts in width,—this serving as a general scale of proportions for an apparatus of any size. The proportions for an efficient apparatus, as my own, may be, for the first space, ten-eighths of an inch (one inch and one-fourth;) for the second, five-eighths of an inch; and for the third space, fifteen-eighths, or rather two inches, making the width of the apparatus itself somewhat above five inches and a half; its height being equal to its width, a projecting rim at the bottom likewise to insulate it from the table. It will be perceived that in the figure there are seven very small holes or apertures in the central part of this cover, (one in the centre and six round at due distances,) just sufficient for the escape of the air, to admit of the ascent of the freezing mixture in the middle part of the vessel. This apparatus is somewhat elevated at the top, or slightly convex, and the part in which the apertures are placed, guarded by a shallow rim to prevent an accidental running over of the mixture into the part containing the cream. This apparatus should be furnished (as expressed in the figure) with an outer cover similar, but less elevated, to the one at Fig. 2. Previously to use, it will be proper to ascertain the quantity of liquid the apparatus will contain when together, and mark its height; likewise the proportion of the ingredients for furnishing a given quantity in measure should be known. Thus, if the three salts are used (which I would

recommend to a private individual, always doing so myself, although these cannot be recovered for future use, but being more efficacious than the two only) for each pint, small or old measure, will be required of sal ammoniac and nitre (each equal parts by weight reduced together into fine powder) six ounces, and of Glauber's salt, in clear crystals and dry, four ounces and a half, freely reduced to fine powder, or kept from the access of air, and in a separate parcel from the former; and water ten ounces, or enough to make up one pint in measure when added to the former ingredients:—of course, the whole must be well stirred together, and expeditiously, before introducing that part of the apparatus which contains the article to be frozen, and occasionally afterwards, till the object is completed, avoiding as much as possible any accidental accession of heat. A freezing mixture composed of sal ammoniac and nitre, with water, all at the temperature of 50°, to which temperature, or nearly so, they may all be reduced by water from a pump by drawing off a sufficient quantity first, will from 50° produce a cold of 22° below the freezing point, and with the addition of Glauber's salt to 28°. The confectioners find a degree of cold at 12° or 15° below the freezing point sufficient for their purpose; but it must be recollected that the cold produced by salts dissolved in water, is not so durable as with ice and salt; the duration of the refrigerating power in the above mixtures, will, of course, be in proportion to the quantity and thickness of the apparatus. In the way the confectioner managed, the mixture in the apparatus retained its freezing property till the morning: my usual way, is, in extreme hot weather, to place the vessel containing the powdered salts in the coldest water drawn from the pump previously; but in the ordinary way it will suffice to add the cold water without the above precaution: it may be adviseable to be provided with a second quantity of the ingredients to preserve the cold by a renewal of the mixture. The drawings are taken from an apparatus of each kind of my own,—they are made of tin, for want here of a fitter material, and are painted outside of a grass green colour. The confectioner abovementioned laid in a stock of a hundred weight of each of the articles; viz. sal ammoniac and nitre; the former at the rate of one shilling per pound, and the nitre at four pence—which, of course, when mixed, was at the moderate price of only eight pence per pound. Glauber's salts may be procured in the large way at the rate of about two pence per pound, and by the single pound at four pence. The apparatus abovementioned may be only half or three parts filled for use; care must be taken in every instance, that the surface of the subject to be acted upon be rather below the surface of the freezing mixture.

For cooling wine, the coldest water drawn from a pump will be quite sufficient; however, if required, a small portion of the cooling powder may be added to the water.

The addition of Glauber's salt, it may be observed, increases the density of the mixture, which then becomes a better conductor of the cold, if I may so express myself, and moreover retains the same temperature longer: of course it will be better of the two to over-

charge than undercharge the proportion of the salts to the water. It will be apparent, for obvious reasons, that the part containing the subject to be cooled should be as thin as may be, and the whole of the external part in every apparatus thick.

This detail may probably appear prolix to any person induced by curiosity only to look it over; but to any one who means to put it in practice, the whole will be found essential, and with a little attention and experience become familiar and easy, and in which I have endeavoured to combine every advantage the subject will admit of; and as coming from the "fountain head," it may not prove uninteresting to some, at least, of your numerous readers. I am, gentlemen,

Your most obedient servant,

RICHARD WALKER.

Oxford, April 28, 1828.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN SEPTEMBER, 1829.

With Remarks and Exemplifications, by the Editor.

1. For an improvement in the construction and operation of the *Printing Press*, denominated "Booth's Improved Double Printing Press;" Jonas Booth, sen., James Booth, Thomas Booth, Jeremiah Booth, and Jonas Booth, jun., New York, Sept. 1.

In this press the platten is firmly fixed, and the table, or bed, and form, are made to rise up to it, by means of levers adapted to that purpose. The form has no horizontal motion, there being a frame, carrying an inking roller, which passes in between the form and the platten, to ink the former. The sheets to be printed are carried in, and delivered by means of straps, one being carried in, and another delivered, whilst the form is inking. There is no claim, and of course the whole arrangement is intended to be patented. The mode of supplying the rollers with ink, and the structure of some other parts, are such as are well known.

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2. For a *Furnace Cooking Stove,* which may be altered at pleasure into an open stove, similar to a Franklin fire-place, called the "Alterable Cooking and Franklin Stove;" George Richards, Providence, Rhode Island, September 9.

The intention of the inventor of this stove, is to furnish an article which may be *conveniently* transmuted from one form to another, but we apprehend that most persons will object to the removal or addition of a part, or, indeed, several parts of an apparatus of this description, and will deem it *inconvenient* rather than otherwise.

When this stove is to be used as a furnace cooking stove, only, the parts which form the sides of the Franklin, are to be doubled back, whilst the top, with its brass ornaments, and an elbow pipe, are to be removed, and stowed away, together with the furnace and

some other appendages. We do not see any thing in it requiring a more particular description. The claim is to "the peculiar *combination, form,* and construction of this stove, with its *moveable* furnace, *top, sides, mantel piece,* &c. &c.

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3. For an improvement in the *Brick Pressing Machine;* John Woodson, Rockbridge county, Virginia, September 10.

An upright iron rod, is fixed so as to slide up and down in front of a strong vertical post; on the bottom of this rod, is the platten, or follower, which is brought down on the mould containing the brick. The force is applied by hand, to a progressive lever, and the brick is to be thrown out of the mould, by means of a weighted lever, which is made to act under the brick, when the lever of the press is raised. The claim is "the combination of the different parts, the application of the lever power, and the increasing power of the lever."

We do not perceive much of novelty in the arrangement, nor do we believe that any one can sustain a claim to "the increasing power of the lever," when the operation of the progressive lever is so well known, and so frequently employed.

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4. For a new and improved construction of *Vaults and Privies;* Thomas Rundle, Boston, Massachusetts, September 10.

Numerous patents have been obtained for water closets, both here and in Europe, and many of them answer the purpose contemplated in a very perfect manner. The apparatus proposed by the present patentee, as a substitute for them, would require an engraving in order to its explanation, and we are not of an opinion that it merits this expense, as we doubt its practical utility. There is an array of levers, valves, strainers, an air pump, and many other appendages, no particular parts of which are claimed, the whole arrangement being, and we believe justly, considered as new. A very perfect and beautiful model is deposited in the patent office.

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5. For an improvement in the mode of *Covering Houses with Tin-plate, Sheet-iron, or Zinc;* Richard S. Tilden, Lynchburg, Campbell county, Virginia, September 10.

The specification states that "the sheets are to have an edge of about half an inch turned on each side in order to lock them together, and in putting them on the house, one or more clamps, as necessity may require, are used, one end of which is locked in the groove formed by the edging of the sheets, and the other edge is nailed to the sheeting plank, which secures the sheet to the roof."

"What I claim as my improvement, is, the use of the clamps, by which the sheets are made fast to the roof, thereby protecting the nails from the weather, and the possibility of leakage through the nail holes, and differs from the old plan, inasmuch as it prevents the necessity of nailing through the sheets in order to secure them to the roof, thereby leaving the nails in a great measure exposed to the

weather, and the probability of the rain penetrating the nail holes." We do not clearly understand the description given by the patentee, and it does not appear that his specification is accompanied by a drawing of the mode proposed. He speaks of "the old plan," as though but one had been known, and seems to consider it as having been the practice to leave the heads of nails exposed, in both of which assumptions he is altogether incorrect. Perhaps some of our readers may be able to discover the intention of the patentee, and be able to point out that novelty and utility which have escaped us.

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6. For an improvement in the art of *Manufacturing Sugar from Cane Juice;* Ebenezer Avery Lester, Boston, Massachusetts, September 10.

The plan proposed is to employ the discharge steam of the high pressure steam engine, so that its heat shall cause the evaporation of the juice. It is stated that the steam may be conducted, by a tube, nearly to the bottom of a wooden, or other vessel, containing the juice, and discharged directly into it; that in this case, the quantity of moisture will be at first increased by the condensation of the steam, but that the liquid will soon arrive at the boiling point, and the evaporation then go rapidly on. It is proposed sometimes to conduct the steam through the juice, in tubes, similar to the worm of a still, and thus to prevent the contact of the steam and the juice.

When the sugar is to be grained by means of the steam, it is to be put into a wooden, or other vessel, with a double metallic bottom; between which bottoms the discharge steam is to be admitted.

The claim is to "the application of steam in the manner before specified, to the evaporating and boiling of cane juice, and the graining of sugar. Steam never having been thus used for these purposes until my application thereof."

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7. For a *Washing Machine,* and for heating water for the same; Enos D. Cherry, Auburn, Cayuga county, New York, September 10.

A box, or trough, is to be divided into three or four compartments, by partitions extending from one side to the other. In one of these compartments there is to be a stove of sheet-iron, the mouth or opening of which is to pass through the side of the trough, and to be secured to it by flanches. In this stove, surrounded by water, the fire is to be made. Tubes from this compartment may be made to lead into either of the others.

The washing compartment has a circular segment, with grooves, or rollers; upon this segment the clothes are to be placed, when they are to be acted upon by rubbers, or grooved pieces, suited to the lower segment, placed upon a swing frame, operated upon by springs. "The washing machine may be made separate from the boiling apparatus."

There is no claim, either general or particular.

8. For a machine for *Thrashing Wheat and other small Grain;* James S. Wood, Pattensberg, Battetort county, Virginia, September 10.

The cylinder which carries the flails, or beaters, in this thrashing machine, is constructed in a manner very similar to that of many others, the beaters extending from one head of the cylinder to the other; but they are not attached to the circular heads, being fixed on springs, fastened to the centre of the shaft. The floor upon which the grain is to be placed, stands also on springs, although, it is stated, that the machine will answer perfectly well if either part is so fixed, the other being permanent, or stationary. The claim is to this fixing upon springs, which is accounted the distinguishing feature of the instrument.

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9. For a machine for the purpose of *Washing Alluvial Earth, Clay, and Soft Ores,* and separating and saving the gold from the same; William H. Folger, Mechlenburg county, North Carolina, September 10.

A principal part of the apparatus described in the specification of this patent, is called a tipping box, in which the earth, &c. is to be agitated with water, for which purpose the box is suspended upon pivots. There are also described instruments for grinding, raking, and other purposes, which do not appear to us to offer any thing of special interest, or novelty; they, however, are minutely described, and collectively claimed in the following words. "I claim as original the things above described, and the manner of using them, with the exception of the bevel wheels, trundles, and cog wheels, and moving power."

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10. For an improved *Veneering Saw;* A. F. Smith, Salem, Essex county, Massachusetts, September 10.

The description of the invention will be given in due time; the arrangements of the patentee requiring that it should not be immediately published.

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11. For an improved *Auger,* called the "Serpentine Screw Auger;" George Shetter, York county, Pennsylvania, September 10.

The difference between this and the common screw auger consists principally in continuing the circular shank or stem of the auger down through the body of the screw part, as in some cork screws, or, in fact, as in screws in general. The patentee observes that "the spiral, or rim, may be continued on the shaft, or stem, any length, and the auger will bore freely and easily, without drawing it from the hole."

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12. For a *Washing Machine;* George A. Stocking, Aurelius, Cayuga county, New York, September 10.

This machine is very imperfectly described in the specification, and very miserably represented in the drawing; no part of it is claimed as new, and we are, therefore, to take it for granted that the whole is original.

A wooden cylinder, the periphery of which is formed of rollers, is to be turned by a crank; below the cylinder is a spring board, furnished with rollers, and by turning the crank backwards and forwards, the clothes are made to traverse between the roller and the spring board.

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13. For a *Self-adapting Rail-way Carriage;* James Wright, Columbia, Lancaster county, Pennsylvania, September 10.

The specification of this patent will be found at p. 272.

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14. For an improved *Lamp;* Isaiah Jennings, New York, September 10.

The specification, with a drawing, will appear in an early number.

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15. For a *Machine for Planing Timber*, boards, plank, clapboards, window blinds, sash-stuff, cabinet work, tongueing and grooving, straightening the edges, and reducing to a thickness and width, all kinds of wood for various uses; called the "Improved Circular Planing Machine;" Uri Emmons, New York, September 10.

On the 25th of April last, a patent was obtained by Mr. Emmons for a machine for planing, tongueing, &c., which he called the Cylindrical Planing Machine, and which we noticed as being similar to that for which Mr. Woodworth had obtained a patent in December last. In the specification of the present patent, no allusion whatever is made to that previously obtained, and it is, therefore, to be considered as entirely new.

The board, or plank, to be planed, is fixed upon a sliding plank, or carriage, moved forward by a pinion working in a rack on its under side. The plank is to be held down, whilst planed, by rollers which press upon its surface. There is a cast-iron wheel, the diameter of which must somewhat exceed the width of the stuff to be wrought; this wheel is to move horizontally above the top of the board, its edges are furnished with cogs, by which it is to be turned; near its periphery it is perforated to receive four plane irons, or cutters, which project from the lower side, and are fixed and regulated in their places by means of screws. These irons so fixed, cut by a circular traversing motion. The tongueing and grooving is effected by wheels furnished with cutters on their edges, and adjusted to the width of the stuff, motion being given to these by gearing connected with the circular plane. The claim made, is,

"1st. The simple form and construction of the above machine.

"2nd. The principle of a cast metal circular plane.

"3d. The principle of running timber over or under the centre of a circular plane, as above described.

"4th. The driving of the edging, tongueing, and grooving [wheels] by the plane itself, thereby rendering the apparatus simple, cheap, durable, and easily altered, and set, for the different kinds of work.

"5th. The application of the machine to the foregoing and all other purposes to which the same, as before described, may be made to apply."

Among the many patents which have been obtained, here and in other countries, we apprehend that some will be found, which will interfere materially with some of the *principles* above claimed. The first claim must be considered as mere surplusage, as it is altogether indefinite. The term *principle* used in the second and third, is equivocal in its meaning; taken in its most exact acceptation, such a claim would be too broad. We should prefer to read it "the using of a cast metal," &c. and "The running timber," &c. We have seen revolving planes operating very much upon the *principle* of these, but the planes were carried by horizontal arms projecting from a vertical shaft, along side of which the timber was made to pass. We apprehend that the running the timber under the centre is new, the plate being supported by a frame, above the board to be planed. Were the plane made of wood, or of wrought metal, would this interfere with *the principle* of a *cast metal* circular plane?

The grooving wheels appear to resemble those used by Mr. Woodworth, and those also described by Mr. Emmons in his former patent. What is now claimed is the mode of driving them. This claim may be good, if the right to the circular cutters themselves vests in the patentee. We make these remarks, because we are anxious to impress upon those applying for patents the necessity of precision in their descriptions and claims.

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16. For *Making Paper from Straw;* Louis Bomeisler, Philadelphia, Pennsylvania, September 10.
(See the specification, with remarks.)

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17. For an improvement in the art of *Constructing and Building Lime Kilns,* for the purpose of burning lime; Louis Bomeisler, Philadelphia, Pennsylvania, September 10.

Particular directions are given in the specification of this patent respecting the dimensions of this kiln, the height of which is to be about 16 feet, and its greatest diameter nearly 14, its form is egg-shaped. There are no particular points claimed, although several provisions are pointed out which are said to render it superior to other kilns; such as the manner of supplying air to produce a more equable heat, and a more perfect combustion than has hitherto been obtained; it is also said that the mode of building certain parts serves to shelter the workmen who feed and tend the fire. The principal improvement proposed, is, the employment of that heat which is usually permitted to run to waste, and the consumption of that por-

tion of the fuel which is ordinarily allowed to escape in the form of smoke, but which, by a due supply of air, is caused to burn, in consequence of which it leaves the kiln in the form of flame, and is thence conducted into another kiln, or oven, for the purpose of burning brick. The crown of the lime kiln is left open, to charge it with stone, the diameter of the opening being 7 or 8 feet: there is a cap, or cover, to this opening, which is to be lifted on and off by a crane, or sweep; this cap, or cover, has an opening in its centre, of three feet in diameter, to receive a sheet-iron pipe, which is to conduct the flame into the oven, or kiln, containing the bricks; the structure of which is such as to cause the flame to circulate in it in such manner as is deemed most advantageous. The heat which escapes in using twenty cords of wood, the quantity necessary to burn fourteen or fifteen hundred bushels of lime, it is observed, is enormously great; the improved kiln is stated to save this heat, by applying it as above mentioned. The heat thus communicated, will be sufficient to burn such bricks as do not require a greater heat than that which is necessary for the burning of lime, and any additional heat may be obtained by obvious means, if necessary. "The result of this improvement, is, to convert to profit a considerable part of the heat hitherto lost, and to reduce the quantity of fuel necessary to burn lime."

A more particular description would require a drawing; that which accompanies the patent affords but an imperfect representation of the kiln, being merely a rough outline section.

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18. For an improvement in the *Application of Machinery to the Inclined Plane, for Rail-roads and Canals;* Sands Olcott, Hursimus, Bergen county, New Jersey, September 11.

The drawing and description, as given by the patentee, present a rail-road carriage, across the centre of which there is an axle, or shaft, supposed to be driven by a steam engine, which shaft communicates motion to the axles of the carriage wheels by means of drums and chains. When an inclined plane is to be ascended, or descended, a chain reaches from its foot to its summit, being fastened at each end to fixtures in the ground; when out of use, this chain lies upon the ground, and is then called the ground chain. Upon the middle of the main shaft, there is a drum, which, when the carriage travels upon a level, is not in use, but when it is to ascend an inclined plane, the ground chain is to be unfixed, then passed twice round the drum, and its end again fastened to the standard in the ground; the carriage wheels are to be thrown out of gear, and the engine started, the friction of the chain upon the drum will then cause the carriage to ascend. When it is to descend, the chain is fixed in like manner upon the drum, the back and front wheels to be put in gear with the drum shaft, and the steam engine thrown out of gear. The carriage is then to descend by its gravity, its motion being regulated by a brake, acting upon a fly wheel.

The claim is to "the applying the principle of the ground chain,

or rope, and drum, to the use of inclined planes for rail-roads and canals."

The use of chains, ropes, and racks, employed in various ways, is well known to those who have attended to the subject in question, and we are at a loss to discover the peculiar advantage of the plan now proposed. Will a locomotive carriage, which is intended for drawing a train of loaded carriages upon a level road, draw this train up an inclined plane? We wot that the gravitating force would be too great for this, excepting the plane were but little inclined. What is the use of the chain in descending? If the carriage is to descend by its own gravity, what necessity for any thing more than the brake? How is this carriage to be applied on the inclined plane of a canal? This we are not told, and to us it seems that a fixed engine at the top, which had not to perform the labour of carrying itself up, would be more effective than a locomotive engine.

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19. For an improvement in the *Plough;* Thomas Brown, New York, September 11.

The specification begins by saying that "The plough is entirely of iron, and so constructed and put together, as to render it the most easily managed, the most durable, and the cheapest article of the kind ever offered to the public." So far, so good. We however find nothing in the description tending to confirm this enunciation of qualities, as it appears to be like most other ploughs, only that it is made "entirely of iron," with the exception of wooden handles, for the comfort of the ploughman in cold weather. The different parts, we are informed, may be made either of cast or malleable iron. We some time since published, with remarks, some account of a plough entirely of iron.

As the patentee claims nothing, his right is hardly matter for disputation.

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20. For communicating motion to mill, and other works, by *Applying a Water Wheel to the Current of a River,* and for the machinery to effect the same; Joseph Wallace, Hartford, Ohio county, Kentucky, September 11.

A water wheel, made in the ordinary manner, has one end of its shaft supported on a wharf, or bluff, at the side of a river, and in order to communicate motion to the mill, is there connected to a horizontal shaft, by means of a universal joint. The other end of the shaft rests upon a boat moored in the river, at a distance of thirty feet, more or less, from the bank. The boat is retained in its place by arms which extend from it to frame work on the shore; and there is a contrivance for raising or lowering the gudgeon of the shaft in the boat. The claim is to "the mode of communicating motion to the mill and other works, by applying a water wheel to the current of a river, and in the machinery to effect the same, as above described."

The communicating of motion to machinery on shore, by a current wheel, has been frequently done; and we doubt the existence of any thing in the application of the universal joint, upon which to found a claim; perhaps, however, we are fastidious, and others may see invention where we discover variation only.

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21. For an improvement in the manner of *Drawing Water through Forebays,* to be discharged on water wheels; James P. Espy and Andrew Young, Philadelphia, September 11.

Men of science are aware that experiments to ascertain the effect of tubes of different forms upon effluent water, have been performed by Venturi, and others, and that some very remarkable results were obtained. The tubes, or openings employed, are called *adjutages.* At page 280 of the present volume there will be found an investigation of this subject by Mr. Charles Potts; the facts are also noticed in all modern works which treat upon the subject of hydraulics.

The patentees state expressly, that their improvement consists in "applying Venturi's adjutages, and thereby increasing the quantity of water discharged through a given opening, under a given head, and thus increasing the power of the wheel."

We are not aware that the question has ever been decided, whether a claim of this kind is good in law. Patentable objects are "any useful art, machine, manufacture, or composition of matter," "not known, or used before the application;" or any improvement upon either of them; the main question therefore is, whether the application of a well known principle in the production of a *well known* effect, can be arranged under either of the foregoing heads.

The advantage to be derived by the application of the adjutage in question is to the tenant, or purchaser, of a water right, who is allowed, by his agreement, to draw a given number of inches of water under a given head; by adopting an adjutage somewhat in the form of that given in fig. 7. p. 282, this quantity will be greatly increased.

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22. For *Cast-iron Copings, or Finishing for Chimneys,* fire guards, ridges, &c. of buildings; Charles Neal, Waterford, Saratoga county, New York, September 11.

It is altogether unnecessary to give a description of either of the above articles, as the claim is to "making the above described copings, or finishings for buildings, of cast-iron, instead of other materials, as heretofore used; and also the peculiar construction of the same as above described."

The *peculiar construction* alluded to, is the provision that they may be cast either in one or more pieces.

We have repeatedly given an opinion that a claim like the above is not good, as it consists merely in a change of the material used, and cannot be properly denominated either an invention or discovery. Were we to build a house of cast-iron, should we interfere with the

rights of the present patentee. because our chimney tops, and other finishings, were of that material?

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23. For improved *Iron Hubs for Carriages;* Hercules Thomas, Middleborough, Plymouth county, Massachusetts, September 11.

There is a want of clearness in the description of this hub, or nave, which is not removed by the drawing; the main object appears to be to fasten the wooden spokes firmly, by screwing a nut upon one end of the hub, which acting upon a sliding collar, presses the spokes between flanches or cheeks, projecting out for that purpose. Upon the inner edge of these cheeks are "processes," projecting angular pieces, to notch into the spokes; and between the bottoms of the spokes "processes" project to steady, and keep them in their places.

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24. For a *Fly Net,* for saddle, gig, or carriage horses; Henry Korn, Philadelphia, September 12.

This net in its construction resembles the well known leather thong nets. "The net is constructed with three longitudinal straps of cotton, worsted, or silk, either woven, plaited, or braided; the ribs, or thongs, are woven, plaited, or braided, into the longitudinal straps, at right angles, and in a durable manner; the cord used for the ribs, or thongs, is substantial braided cord, far superior to twisted, or other kind of cord."

The utility of this net is said to consist in its being light;—easily kept clean;—being of substantial materials;—that, its colour being bright, it will attract the flies, they preferring it to the darker skin of the horse;—its lightness will tend to keep it in motion;—it may be fixed and removed very readily;—the coloured cotton may be easily washed;—the white cotton, worsted, or silk, easily dyed; the comfort of the horse, and the safety of the rider, will be promoted.

There is no claim; a drawing accompanies the specification, but is not referred to.

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25. For an improvement in the *Machine for Cutting Pannels for Carriages, and other Work, and Veneers,* around, or off, the circular surface of a log; Job White and Phineas P. Quimby, Belfast, Waldo county, Maine, September 12.

On the first of May last, a patent issued to Caleb B. Burnap, of Belfast, Maine, for a machine for cutting veneers in one continuous sheet, around a log. We have since seen specimens of the veneers so cut, which were perfectly well executed. We believe that the claim of Mr. Burnap was to the machinery employed by him, only, and not to the cutting around the log, although we think such a claim might have been sustained. The present patentees use circular saws, but turn them and the log, and also give the traversing motion by machinery constructed differently from that of Mr. Burnap.

Their claim is to "the application of the circular saw, in the manner described by them;—to the combination of the machinery, whatever its position;—and to the raising of the gate, so as to permit a greater flow of water in order to increase the crank motion, as the log diminishes in size, by means of a screw, gearing, or lever, attached to the machine."

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26. For improvements in the common *Water Pump;* John Washington Hillias, Baltimore, Maryland, September 16.

The improvements here patented are intended to prevent the introduction of stones or other hard substances through the spout of the pump, or through the slot in which the handle works; and for a better mode of fastening on the head of the pump than that of nailing.

Sliding pieces are fixed in grooves, and pressed forward by springs, so as to close the slot, or mortise, in which the handle works; and a valve, opening outwards, is applied within the spout, to allow of the exit of water, and prevent the introduction of foreign substances. The head of the pump is to be fixed on by spring catches, and staples. These are the improvements which are claimed.

The heads of pumps are not every where fixed by nailing; we have repeatedly seen them fixed by staples, hinges, and locks. We some years since contrived a mode of effecting the principal object above proposed, the preventing the introduction of stones, &c. which we will some day describe.

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27. For a machine for *Planting, and Preparing Seeds for the same;* Zebina Lane, Harrisburg, Lewis county, New York, September 21.

The specification of this patent is of considerable length, and describes the machine without reference to the drawing, and although evidently written with much care, is not, alone, very intelligible. The drawing is miserably executed; the details of the apparatus cannot therefore be understood without the devotion of more time than we can at present spare. At page 343, vol. 2, of the new series, a planting machine is described, which was invented by Messrs. Robbins, of Lewis county, in New York; and to us it appears that the machine now patented, is the child of the former; how near the resemblance may be, we are unable to state, for the reason already given.

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28. For an improvement in the *Manufacture of Harness Trimmings, and Carriage Ornaments;* William S. Robinson, Taunton, Bristol county, Massachusetts, September 22.

The improvement proposed is the making of metallic furniture for harness, or coach ornaments, by using a composition of metal, resembling Brittania metal, and the casting them in brass moulds, so as to require but little finishing; as it is not pretended that the

recipe for the composition is a new one, we insert it. A composition is first made, called hardening: this is formed by melting together three pounds of copper, seven pounds of block tin, twelve ounces of antimony, and twelve ounces of bismuth. Seven pounds of this, melted with thirty three of block tin, form the metal in question. The claim is as follows:

"That which I claim as new, and as my invention, is the application of the above described composition of metal to the manufacture of harness and carriage trimmings, in those cases where silver plated work has been heretofore used; and likewise the manufacture of said trimmings by means of moulds, whereas the common trimmings are cast in sand, and cannot be cast in moulds;—but I do not claim as new, the composition of the foregoing ingredients into one metal, since a metal has been before manufactured from the same ingredients, though used in different proportions; nor do I claim the invention of the moulds, which are made of common materials, and in the usual way, but which have never been used before for a like purpose."

That is, although buckles, beads, and ornaments of various kinds, have been frequently cast of a similar metal, and in similar moulds, an exclusive right to the casting of buckles, beads, and ornaments for harness and coaches, is claimed by the present *inventor.*

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29. For *Manufacturing Perpetual Polished Water-proof Boots and Shoes;* John Ryan and John Haskins, of Boston, and Samuel Known, of Roxbury, Norfolk county, Massachusetts, September 23.

The whole specification is as follows:

"This improvement in the manufacture of boots and shoes consists in the application of *japanned water-proof leather* (such as has heretofore been used for caps) to the manufacture of boots and shoes, so far as regards the *upper* leather of boots and shoes, and the insertion of a *layer* of said japanned leather between the *outer* and *inner* sole; by which means the whole boot or shoe will be perfectly tight, and will exclude the water entirely. And boots and shoes made according to this invention will be superior to all others for durability, beauty, usefulness, and cheapness, by being *water-proof*, continuing always clean, and polished, and handsome, without expense of blacking or other process usually adopted for this purpose."

We think this patent in the same *category* with cast iron hammers, cast iron chimney tops, or cast iron horse shoes. We apprehend that the making of shoes of a kind of leather well known, and long used, cannot be taken as an *invention* or discovery. Is it not also a little remarkable that the stocking loom should be the production of "one poor scholar's brain," whilst it required the talents of three gentlemen to invent, or discover, that shoes might be manufactured of japanned leather.

30. For an improvement on the *Machinery for Bending Wagon Tire*, hoops, bands, &c.; Josiah Butler, Cobleskill, Schoharie county, New York, September 24.

The specification is in the following words:

"Instead of having the upper roller regulated by boxes and screws, above and below, as those in use are, it is regulated in the following manner, that is to say, the roller on the improved plan runs in two perpendicular iron standards, passing through the bench, or platform, on which the under rollers are placed. These standards, in which the upper roller runs, are lowered, or raised, by means of nuts and screws working on the iron standards above and below the bench or platform. By this method of setting the upper roller, the machinery is rendered less complex, and may be built with about half the expense, and with equal power and durability."

Specifications of American Patents.

Description of a new mode of applying the power of men to cranks, for turning paddle wheels, and for other purposes; and also for a rudder to be applied to the bow, and of warps to the keel of a ship or other vessel, for the purpose of diminishing lee-way. Abstracted from a patent granted to Adolph Heilbronn, *of New York, March* 16, 1829.

(with a copper-plate.)

The obtaining of the greatest power, or force, from man, for turning the improved paddle wheels, (described p. 194,) or for other purposes, is proposed to be effected by compound cranks, to be operated upon and turned by the hands, and the weight of the body, at the same time, the feet being applied to treadles properly placed and connected to the cranks. Figures 1 and 2, of plate V, are views of the cranks, QQ being the bearings, or pivot, upon which they turn. Figure 1 is a crank to be worked by the simultaneous motion of both the hands of a man moving in the same direction, and figure 2 is a crank likewise for both the hands, but by which greater power is gained; because now the hands move in opposite directions, and oppose each other's force. In figure 1, both the hands are to be applied to the straight bar H; and I, J, are two treadles like those of a foot-turning lathe, each treadle being separate, and hinged to the floor, or to proper framing.

Each treadle is connected by a connecting rod or strap *ll*, as in a lathe, to the two smaller cranks above them, marked K, and L, which form part of the large crank, and are bent in the same plane with it. The person working the machine stands upon the treadles, his left foot being upon the treadle I, and his right foot on that marked J, consequently his whole weight is transferred to them. When, however, he transfers the weight of his body on to one leg only, one short crank will be pressed down, and the other will be at

liberty to rise. In the mean time, the power of his two hands is to be applied to the bar HH, to urge its descent, until it reaches its lowest point, at which times, the short crank K will be in its most elevated position, and after passing the top centre line will begin to descend, at which moment the pressure of the right foot upon the treadle J must be released, and the whole weight of the body thrown upon the left foot and treadle I, while the two hands employed in raising the bar HH, from its, now, lowest position, and so on until the said bar arrives at the highest position in its rotation, when the weight of the body must be again thrown on to the treadle J, and so on alternately. The crank shown in Figure 2 is the same in principle as Figure 1, but is to be preferred for more powerful action, being stronger, because it has a central bearing at QQ, in addition to its two end ones; and instead of the two hands moving constantly in the same direction, the left and right hand cranks are diametrically opposite to each other, consequently when one hand is down the other will be up; and while one is pushed forwards, the other must be drawn inwards, and vice versa; consequently whenever one arm is pushing, the other will be pulling in an exactly opposite direction; from which circumstance a much greater degree of strength and exertion can be used than in other positions of the body. The short, or foot, cranks in this figure are, each of them, opposed to the longer, or hand, cranks, and are to be connected to treadles as before described, and to be used in the same way. This improvement is equally applicable to a sitting position, like that of rowing a boat, as shown at Figure 3; which shows one of the means by which this action may be brought about; *a*, *b*, *c*, being a crank like that shown at Figure 1, *e* and *f* the treadles, now fixed in a vertical, instead of a horizontal, position, and *gg*, the connecting rods when the large crank is in its upper position and is to be drawn inwards, or towards the body of the man at work, the operation, excepting as to direction, being similar to that already described.

In order to prevent ships and vessels of all kinds from making so much lee-way, as they usually do, an apparatus, partly in the nature of a rudder, is applied to the head, instead of the stern, of the vessel, but differently worked; and certain additions are made to the keels of vessels, which may be used either together or separately. The new head rudder is to be fixed to the head of the vessel in the same manner as a common rudder is fixed to the stern, or in any other substantial and convenient way. The common rudder is worked, and acts, as usual; the only difference between the head rudder and the common rudder is, that the common rudder requires to be very frequently moved by the helmsman, while the head rudder is much more stationary, seldom requiring to be shifted in its position, and that principally when the vessel moves upon a new tack, or has any alteration made in the position of her sails. Figure 4 is a representation of the plan of a vessel fitted with the head rudder; A is a tiller placed over said rudder, instead of behind it, and moved by the side tackles B and C, and are kept steady by the tackle D, which leads from the bowsprit. With a view to produce a still greater

resistance to the wind, certain contrivances are applied to each side of the keel of a vessel, which are called keels of resistance, or wings, and are shown at Fig. 5.—These wings may be made of solid wood, cork, or such like light material, but making them hollow, and of cast iron, or other metal plates, in such way that the water may flow through them, is preferred, in which case they are denominated keel tubes. Fig. 5 shows a vessel in an inclined position, and *i, j, k, l*, is a section of the keels of resistance, or wings, which are applied to both of the sides of the ordinary keel of the vessel, in such form and manner, that when the said vessel lies gunnel to, the side *i*, of the keel of resistance, may stand just perpendicular to the horizon, and consequently in the most favourable position for resisting the passage of the opposing water under the vessel, which is, of course, taking the direction shown by the arrow, and, if it were not for the wing, would pass away without any material interruption. Under the vessel a resisting keel is placed on each side, because when the vessel keels in an opposite direction, the face *k*, of the other resisting keel, would be opposed to the water; the resisting keels, or wings, when made of thin cast iron, or other metal plates, have their insides hollow, and being open at both its ends, the water will pass through them with very little additional resistance to the vessel, particularly if such keel tubes are made of wrought iron or copper plates.

Specification of a patent for making from straw, white and handsome Writing Paper. Granted to Louis Bomeisler, *Philadelphia, September* 10, 1829.

Be it known that I, the said Louis Bomeisler, have discovered and invented a new and useful improvement in the manufacture of fine white writing paper, or composition of matter, or material, for making paper from straw, which I specify in the words following, viz. Take one hundred and twenty pounds of straw (after the knobs are cut off) and put it into a boiler, by layers, on which strew thirty pounds of lime; boil the whole down in water until the straw is nearly reduced to fibres, after which take it out, wash, and press it, in order to clear it of the water. The second operation is a mordant for extracting from the straw the silicious and glutinous matter (which would be injurious, and cause the paper to crack,) which is made as follows, viz. for every two and a half pounds of straw, take one pound of sulphur and three pounds of lime, and twenty-four pints of water, consequently, for 100 lbs. of straw it will require 40 lbs. of sulphur and 120 lbs. of lime, to be put in a boiler and boiled until the sulphur is scarcely perceptible, and until the liquor has a handsome brown colour, resembling strong beer; after which, it is to be removed into a tub sufficiently elevated, in order to draw off the liquor clear, which let run upon the straw; in which situation it must be left for about fifteen hours, when the straw is to be taken

out and washed, in order to prepare it for being whitened or bleached, which is the third operation. After the straw is well washed and pressed, it must be spread out in a box, or recipient, for the purpose of being whitened, which is done as follows, viz. twenty-five pounds of magnesia mixed with fifty pounds of salt, thirty pounds of sulphuric acid, and twice its weight of water; divide the whole into several retorts fitted with tubes for introducing the contents into the box where the straw has been strewed; for the purpose of digestion twelve hours will be necessary, by which time a pap, or pulp, will be produced, fit to make fine white and handsome writing paper, with which pulp proceed in the same way as adopted by the paper manufacturers for making the pulp into paper.

The foregoing is adapted for the making of 100 lbs. of pulp, from 120 lbs. of straw, after the knobs are cut off; my improvement therefore is on making, from straw, fine white and handsome writing paper, not heretofore known or used.

LOUIS BOMEISLER.

Remarks by the Editor. In the first volume of this Journal, page 92, we published an account of a patent granted to Louis Lambert, a French gentleman then residing in London, for accomplishing the same end as that above described, and that by the same means. This publication was made by us in February 1826; the patent was then several months old in England, and had been previously secured in France. To show the *absolute identity* of the two, we will extract a large portion of the article alluded to, as many of our subscribers have not our first volume in their possession:

"First procure a quantity of straw, and cut away all the knots; the straw is then to be boiled with quicklime, in water, for the purpose of extracting the colouring matter, and separating its fibres. When this is done, it is to be washed in clean water, in order to remove the colour that has been extracted, and also the slaked lime. The fibrous substance is then submitted to the action of a hydrosulphuret, compound of quicklime and sulphur in solution, in the proportion of four ounces of quicklime to one of sulphur, with one quart of water, in order to get rid of the mucilaginous and silicious matters. After this the fibrous material must be thoroughly washed in successive waters, until all the alkaline matters are removed, and there is no smell of the sulphur left. It is then pressed to extract the water from the fibres, and bleached in the ordinary way, either with *chlorine*, or with lime, or by exposure to the light and air upon a grass plat. The bleaching process being completed, it is to be introduced into the ordinary rag engine, for the purpose of rendering it to pulp, previously to moulding it into sheets."

To those of our readers who are not acquainted with chemistry, it may be necessary to say that the salt, manganese, [not *magnesia*] sulphuric acid, and water, spoken of by Mr. Bomeisler, are used for the purpose of procuring *chlorine*, by which the bleaching is effected. Mr. Bomeisler has made no claim, excepting to "the making from straw, fine, white, and handsome writing paper, *not before known* or

used." That it was before known, is manifest; that it has been used, is also certain; but we are informed that its texture was not such as to enable it to compete with the paper made of the usual materials.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Vis Inertiæ.

Is there, or is there not, such a property in matter? While certain practical writers deny it, as a thing absurd and totally unwarranted by any thing in nature, other writers, mechanicians, and metaphysicians, still hold to it, and go so far as frequently to make it the foundation to some hypothesis, in reducing natural or mechanical effects to their causes; when, perhaps, the latter might, by a little common-sense-investigation, be established in ordinary principles of science. And too often subtle casuists do appear to choose to involve natural effects in such mystery, the rather, perhaps, that they may thereby, in drawing them out from such a source, unfold therewith some of those finely spun theories which will appear plausible enough and fair enough abstractedly, till we come to follow them up into the labarynthical obscurity of their origin.

Our good old doctor Franklin, for one, was too much a matter-of-fact-man, to see in nature a *vis inertiæ*, "that obstinate power by which a body endeavours, *with all its might*, to continue in its present state, whether of rest or motion." If the *vis inertiæ* had been defined *merely* as that "*obstinate power*," by which a body is *made to continue* in a state, whether of rest or motion, measured by its weight in the one case, or, by its weight multiplied into its velocity in the other, the old doctor would unquestionably have admitted its existence in the same breath with that of gravity and momentum.

I should like to see satisfactory answers to the following questions.

1. If the aim or end of all science be truth, is it not essential that the principles of investigation should be *established* truths?

2. If so, are not error and uncertainty in these principles inadmissible?

3. Why then is one of these principles suffered to remain *subjected* to both of these charges?

It may be answered by the believers in a vis inertiæ, that although satisfactory to themselves, the truth of the existence of such a power in matter, or the *necessity* of resolving certain principles in physics to its agency, *is not demonstrable.*

We hope the advocates of the *vis inertiæ* will excuse our want of courtesy, if without waiting to see if they *can* produce proof of its entity, we proceed, as we conceive, to demonstrate its *nonentity.*

First. A ball, stationary, being struck by another ball of equal weight and magnitude, moving with a force equal to F, both balls shall move on with a force equal to ½ F. Where is the *vis inertiæ* in the ball struck? It may be answered thus: that it was *consumed* in opposing the *vis inertiæ inherent* in the ball moving, and by which

that ball resisted any power tending to stop it, with a force equal to that exerted, in overcoming the *vis inertiæ* of the ball struck. That is to say, then, that the *vis inertiæ* is *destroyed*, that it *no longer exists* in these balls. Let us now suppose one of these *negative* balls proceeding with its force $\frac{1}{2}$ F, strikes another ball, stationary, of the same size and weight, What is the consequence? Why both balls proceed to move with a force equal to $\frac{1}{4}$ F. Do they not? *Then, with* or *without* a *vis inertiæ the effect is the same.* As we can only judge of any power by the effect which it is capable of producing, where there is a *non*-entity of *effect*—it is vain to look for *entity* of power. But supposing we have gone too far in saying that in the latter case, above, the *vis inertiæ ceases to be an active principle* in the ball moving, it only the more directly establishes our final inference. For if the forces after each impulse are divided into $\frac{1}{2}$ F, $\frac{1}{4}$ F, and so on, would they not be so divided if there were no such thing in nature as a *vis* inertiæ? Here we again encounter the horrors of our original dilemma, which again throw us immediately upon the same conclusion, that nonentity of effect is equivalent to nonentity of power. And further, let us follow up this *division* of forces, and see where it leads us. If it be necessary, in the first place, to defend the existence of the vis inertiæ, to admit that the principle is *inherent*, and continued in every mass of matter, whether stationary or moving, and that the counteracting forces in those cases when *first* opposed, destroy each other, and that *thence* it is that no visible *effect* is produced; then of course we may continue to make *theoretically* in the instance of the balls continually communicating the original impulse, an *ad infinitum* division of forces, without ever arriving at a point where the vis inertiæ shall exert itself, or cause a cessation of action. How then can we contend for the existence of such a *power* in nature?

Let us consider it in another light. No one who contends for the *vis inertiæ*, we presume, refuses to admit that the standard whereby is to be estimated the quantity of this power, existent in any mass of matter, is the gravity of that matter. Now it is an axiom in theoretical mechanics, that the greatest conceivable mass of matter may be moved by the least conceivable force. Suppose then that it were required, by means of a lever, to overcome a weight of 1,000,000 lbs. by a weight of 1 lb. Now, if the lever were inflexible, the fulcrum a point, and friction nothing, would the long arm of the lever for that purpose require to be more than 999,999 times the length of the shorter arm? Where then is the vis inertiæ in the larger mass? The only answer to be made here, is, that the *vis inertiæ* being a property inherent in all bodies, all principles in mechanics, where matter is considered, necessarily involve the consideration of the vis inertiæ. But this is taking a new ground entirely untenable, and is at once paramount to denying the existence of a certain principle in matter, independent of gravity and opposed to motion, acting with a certain power, to be considered abstractedly in mechanical effect, with friction, &c.

If then our deductions are correct, if this principle is *not shown*,

nor cannot be proved to exist, either theoretically or practically, by any *effect produced* in the determination of matter acting under the *established* laws of nature, then a power having no effect is a practical, if not a logical absurdity.

Let scientific gentlemen, therefore, explode a term from their writings which is unmeaning, and only tends to obscure science and lead to erroneous conclusions.

I shall take the liberty of closing this communication, by quoting the following extract from a letter of Dr. Franklin's to Mr. Hopkinson, which gives a case in point, and which I think is very happily conceived.

"Suppose two globes equal to the sun and to one another, exactly equipoised in Jove's balance—suppose no friction in the centre of motion, in the beam or elsewhere: if a moschetto then were to light on one of them, would it not give motion to them both, causing one to descend and the other to rise? If it is objected that the force of gravity helps one globe to descend, I answer, the same force opposes the other's rising. Here is an equality that leaves the whole motion to be produced by the moscheto, without whom these globes could not be moved at all. What then does *vis inertiæ* do in this case? and what other effect could we expect *if there was no such thing?* Surely, if it were any thing more than a phantom, there might be enough of it in such *vast* bodies to annihilate so small a force by its opposition to motion!"

A subscriber, and lover of truth.

A. A. D.

Chesapeake and Delaware Canal Line, Sept. 28, 1829.

Elasticity, Ductility, and Strength of Hammered and Rolled Iron.

The following are the principal results obtained by M. Lagerhjelm, with great care, and the use of a very complete and powerful apparatus:—

1. Rolling always gives the same iron the same uniform density. Hammered bars of the same iron are often of different densities, and frequently contain scales. 2. Rolling does not twist the fibre of the bar: hammering sometimes does. 3. The measure of elasticity is the same for both hammered and rolled bars; but the limit of elasticity (measured by the greatest weight which the bar can support for a given sectional surface, without any permanent change of form) is greater for hammered than for rolled bars, if neither have been refolded; but if they have been refolded, the limit of elasticity is increased, and becomes the same for both. 4. Rolling gives more ductility to iron than hammering. 5. Cohesion appears independent of the process employed, and is the same for both. 6. The lengthenings and shortenings (both of which follow the same laws) are not proportioned to the forces which draw or compress a bar of iron in the direction of its length. 7. Elasticity is not changed by tempering. 8. Very different forces are required to produce the same per-

manent change of form in a brittle and a soft iron. 9. The limit of ductility being taken as the length which a bar a foot long will increase by, from the state of unaltered elasticity until the moment of rupture, the most ductile iron experimented with was found to give for its limit of ductility 0.27 of the original length, and 0.722 of the original section. 10. The cohesion is the same for brittle or soft iron, fibrous or not fibrous: so that the absolute strength of iron appears to depend upon its ductility. 11. The volume of the metal increases as the bar is drawn apart; and the specific gravity of the iron at the broken surface is less nearly by 0.01 than that of the same iron taken from an unaltered part of the bar. 12. When the iron is extended, preparatory to its fracture, heat is evolved: the heat is greater for soft than for harsh iron. Sometimes a bright spark appears at the moment of rupture.

[*Bull. Univ.* E. x. 42.

Smoke Disperser of M. Millet.

A REPORT upon this apparatus, made by M. Derosne, speaks favourably of its powers. The apparatus is simple, consisting of a kind of tub pierced with a great number of holes, having the burs outwards. It has been taken into practice by many persons. In order to prove its efficacy, one of them was fixed on the top of the funnel pipe of a stove, and a very close, smoky fire made below. By means of a ventilator, an artificial wind was then made to strike directly and powerfully on the smoke disperser for the purpose of driving the current downwards and making the stove smoke; but neither by this, nor even additional means, could any effect of the kind be produced. The committee could not explain the effect, except by supposing that the cylindrical form of the apparatus presenting only a small surface to the action of the wind was favourable, and that the form of the small apertures in this cylinder, occasioning a great number of contrary currents, produced almost a perfect neutralization of the force of the wind. Whatever may be the cause, the apparatus offers a cheap and effectual remedy for smoky chimneys, when this fault in them is dependent upon the pressure exerted by winds upon the upper aperture of the flue.

[*Bull. Soc. Enc.*

Indelible Ink, or Dye. By M. BRACONNOT.

WHILST engaged in experiments on the production of deep brown colours for dying, at an economical price, MM. Braconnot and Parisot were led to examine the nature of the products obtained by the calcination of various organic substances with potash. These results were found to vary with the substances used: thus, when matters containing but little azote were employed, only little colour could be fixed upon fabrics, and that easily removable by alkaline solu-

tions; but when such substances as flesh, skin, and horn were employed, more permanent and deeper colours were obtained. Suspecting that this difference might be due in part to the sulphur present in these bodies, sulphur was purposely added, and then a deep chesnut brown dye was procured, more permanent than any other of the kind known in the arts. This immediately led to the preparation of an indelible ink, which was prepared in the following manner:—20 parts of Dantzic potash were dissolved in boiling water, and 10 parts of tanned leather parings, in small pieces, with five parts of sublimed sulphur, added; the whole was boiled to dryness in an iron vessel, then heated more strongly with continual agitation, but avoiding ignition, until the whole became soft; then a proper quantity of water was gradually added, and the whole filtered through a cloth. In this way a very dark coloured liquor was procured, which may be preserved for any period in close vessels, and which ought to be retained in well corked vessels, constantly excluded from the air; this presents no difficulty to its use, for a pen full is sufficient to write a couple of quarto pages. It flows much more freely than ordinary ink, does not embarrass the pen with insoluble matter, and resists chemical agents in such a way as to merit the title of indelible ink.

Paper written with it, when subjected to the action of a boiling solution of potash, or strong sulphuric acid, or strong nitric acid, was nearly destroyed, whilst the characters remained unimpaired. Being first immersed in a mixture of chloride of lime and muriatic acid, and then for twenty-four hours in caustic potash solution, which was ultimately boiled to dryness, still the letters were very distinct. Weaker actions than these could of course do no harm, stronger could hardly be devised.

It is presumed that the same preparation will be found very useful in giving chesnut browns, more or less deep in colour, to cotton, hemp, flax, and silk; or to assist other substances in producing colour. Substances tinted by a salt of iron take a deeper tint from this preparation than those not so prepared. It is also proposed to use it upon linen as an indelible ink.

[*Ann. de Chimie,* xl. 221.

NOTICE.

Several original articles intended for this number, have, unavoidably, been crowded out. Among them are the papers of Mr. Potts and Mr. D. H. Mason, read at the monthly meeting of the Franklin Institute. Observations on Mr. Perkins' new Paddle Wheel, and Mr. Thorp's first description of his improvement in spinning cotton. They are in the hands of the printer, and will appear in the next number.

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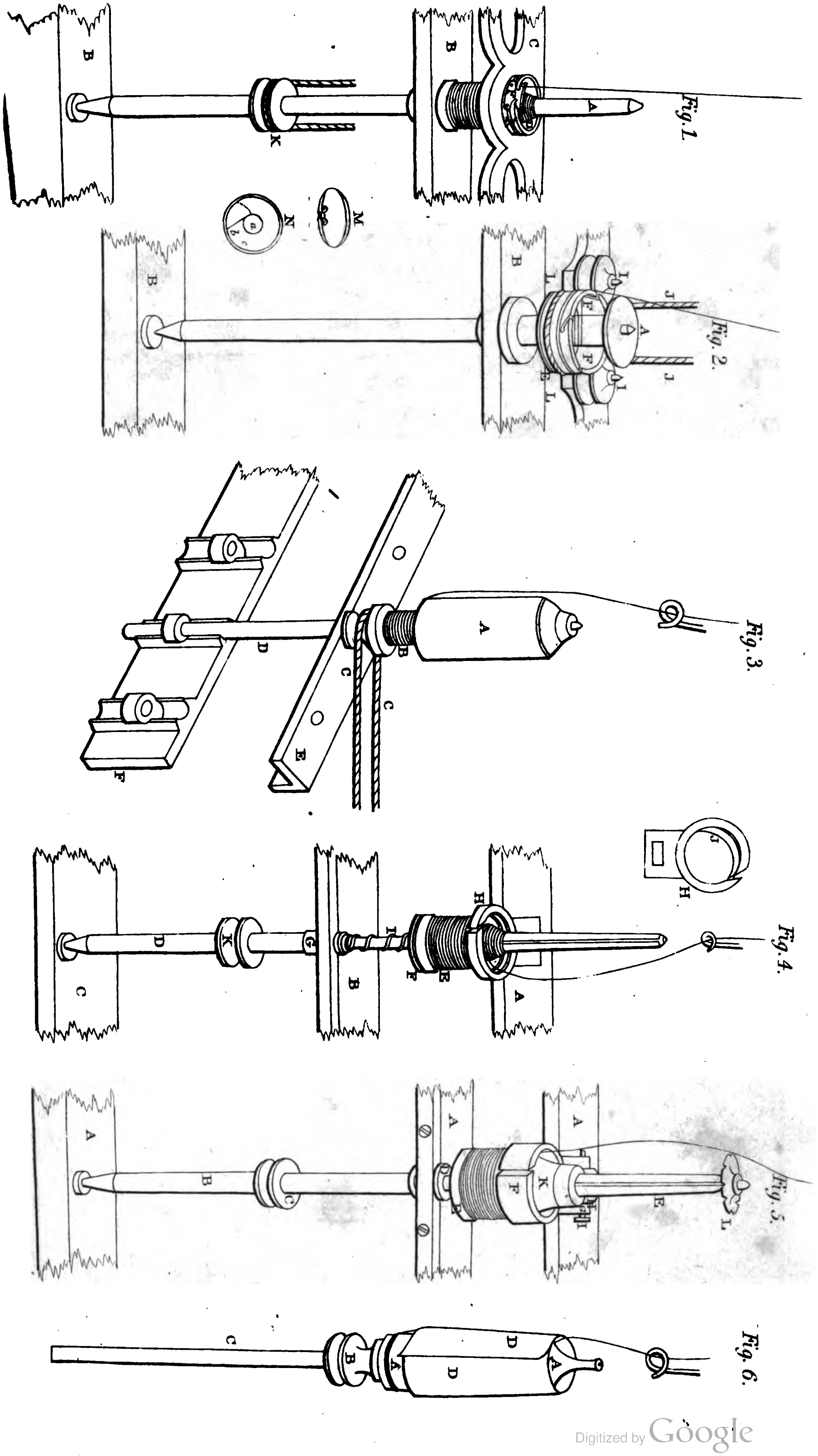
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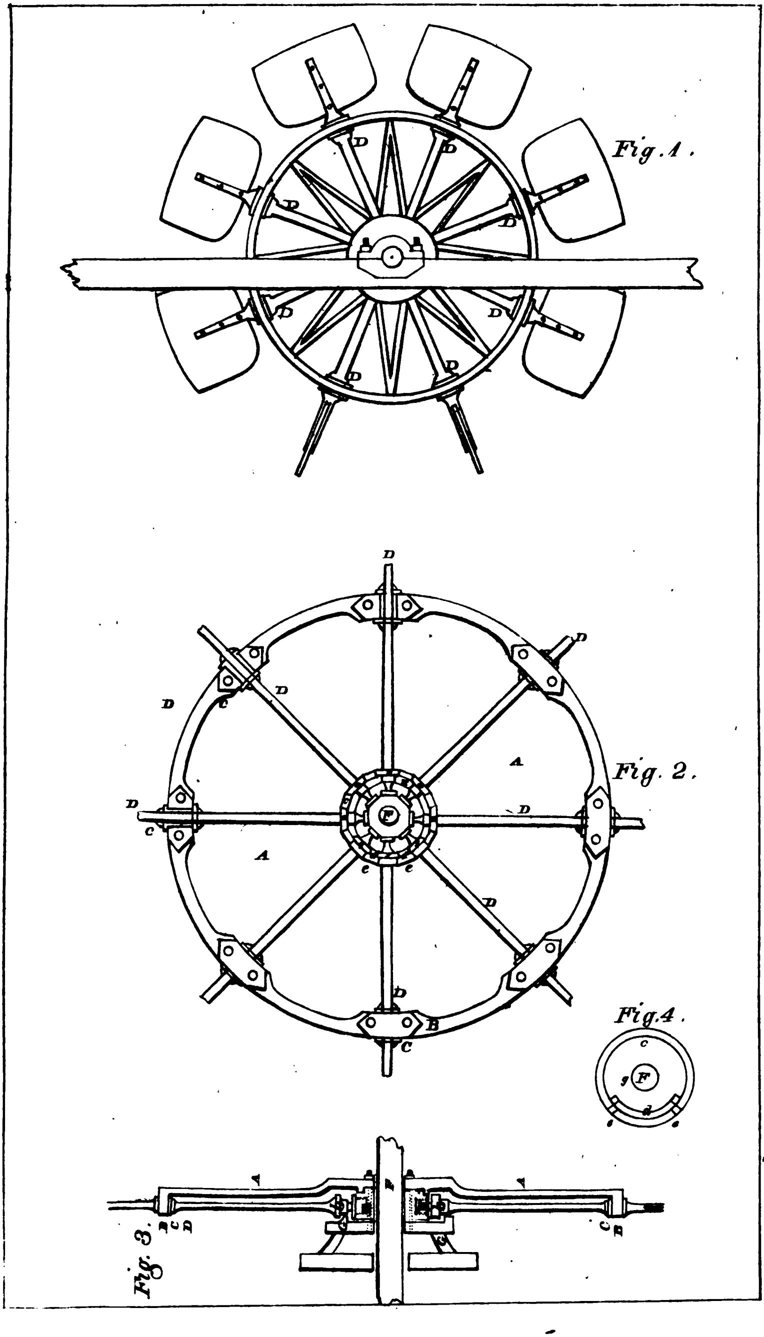
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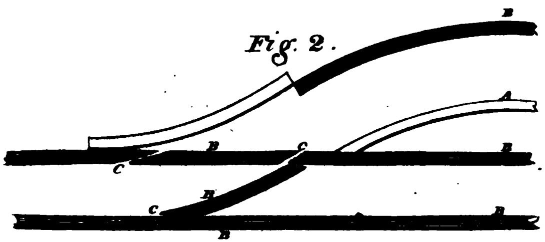

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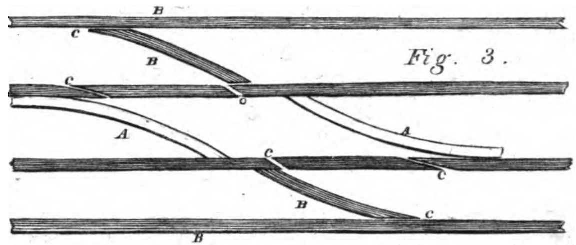

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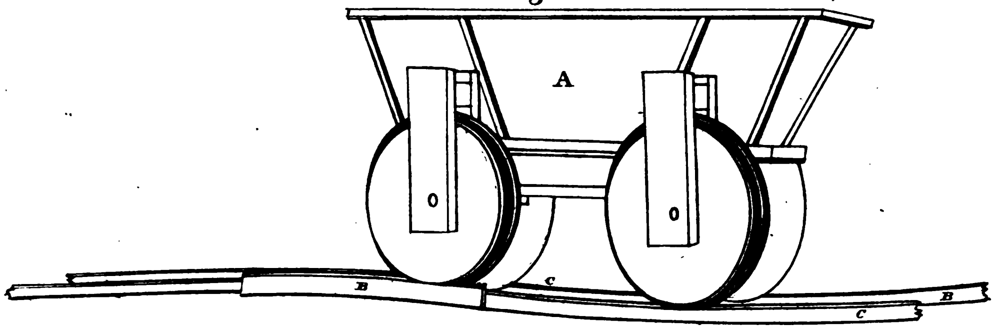

WRIGHTS RAILWAY and CAR

HERMANGE'S BOILERS

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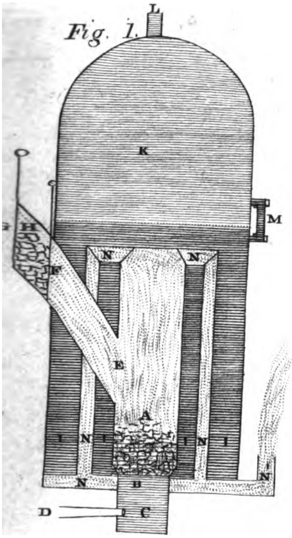

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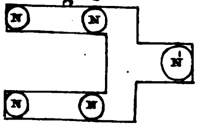

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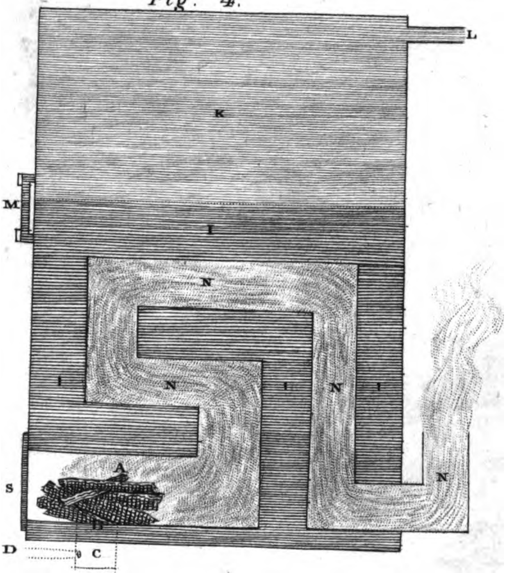

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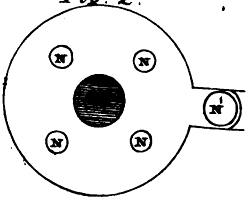

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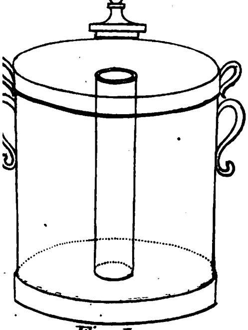

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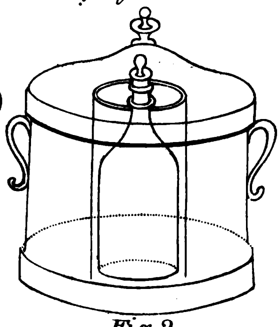

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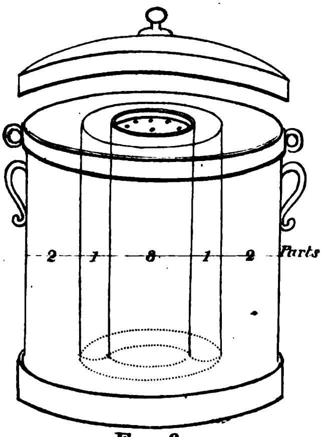

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